FINAL DRAFT

WATER QUALITY IMPROVEMENT STRATEGIES FOR THE EVERGLADES

ALTERNATIVE COMBINATIONS FOR THE ECP BASINS

June 3, 2002

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
West Palm Beach, Florida

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WATER QUALITY IMPROVEMENT STRATEGIES FOR THE EVERGLADES ALTERNATIVE COMBINATIONS FOR THE ECP BASINS

1.0 EXECUTIVE SUMMARY

Florida's 1994 Everglades Forever Act (Act) establishes both interim and long-term water quality goals to achieve restoration and protection of the Everglades Protection Area (EPA). The South Florida Water Management District (District), in partnership with other agencies and private landowners, is aggressively and successfully achieving these interim milestones. Basin-specific feasibility studies will evaluate alternative combinations of private works and public works to achieve compliance with the long-term water quality standards for the Everglades Protection Area. This document briefly describes the set of alternatives to be evaluated for the basins served by the Everglades Construction Project (ECP). A schematic of the ECP basins is presented in Figure 1.

STAKEHOLDERS WILL BE INVOLVED THROUGHOUT THE DEVELOPMENT AND EVALUATION OF ALTERNATIVES. Basin-specific characteristics will help shape the final alternatives. In order to reduce the number of different alternatives evaluated, a concerted effort will be made with the stakeholders of each basin to identify the most viable of the alternatives prior to conducting the evaluation of alternatives. Stakeholder input will be garnered through interactive development of the basin alternatives and updates during the evaluation process. **The District's STA Design Review Staff Meetings have been the central forums for discussion of the ECP basin alternatives.** For meeting dates and locations, please see

http://www.sfwmd.gov/gover/3_mtgcalndr.html

In addition, all draft documents will be available for public review and comment on the District's website,

http://www.sfwmd.gov/org/erd/bsfboard/bsfsboard.htm

1.1 Key Variables for Defining Alternatives

The following key variables were used in defining basin-specific alternatives for the ECP basins:

1. Operational changes, including diversion of flows
2. Basin-scale treatment, including biological and chemical treatment
3. Integration with CERP projects (see Table 1)

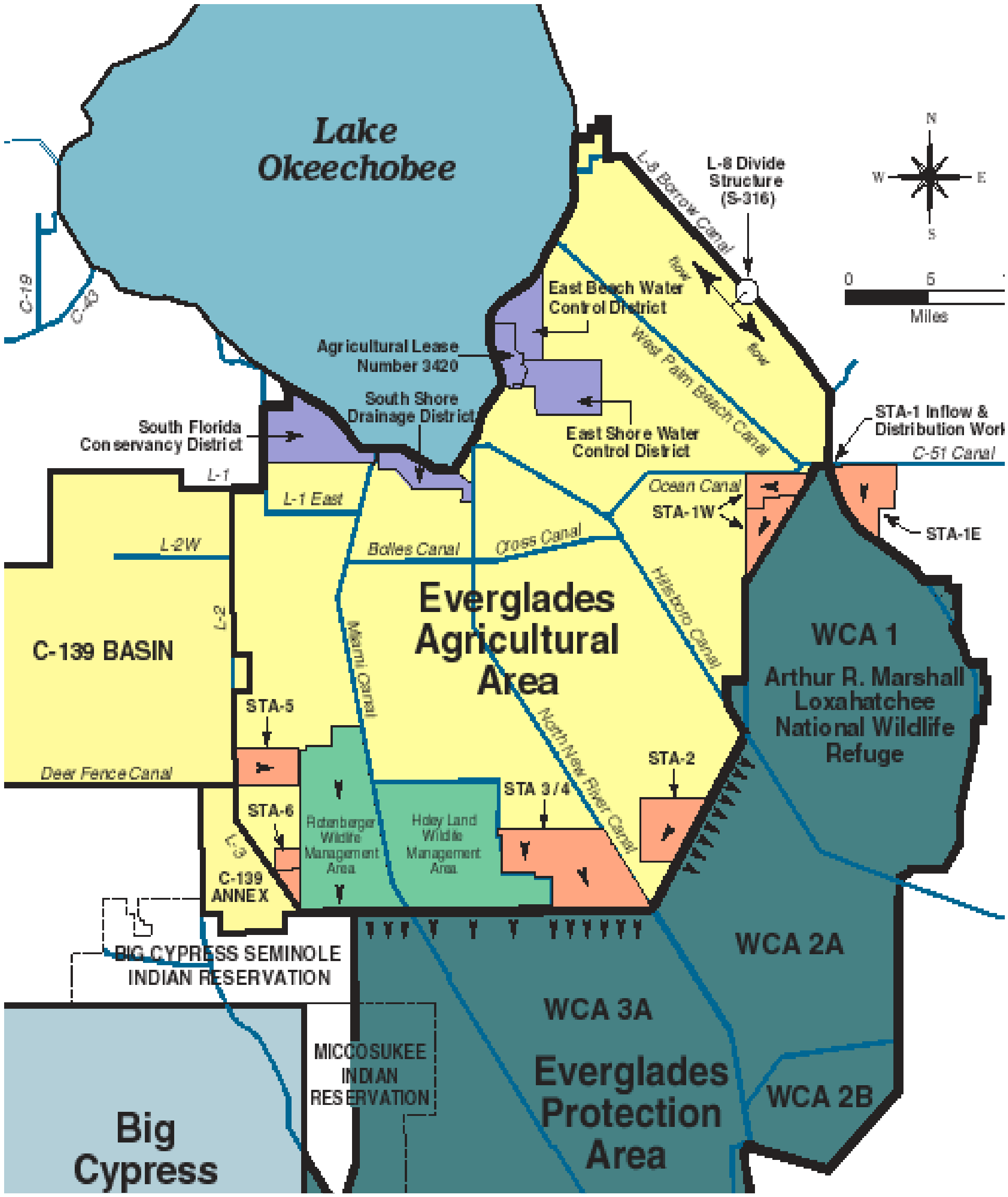


Figure 1. Overview of the Everglades Construction Project.

Table 1. CERP Projects That May Influence Flows and Loads in the ECP Basins

CERP Project	**Completion Date**	STA -1E	STA -1W	STA -2	STA -3/4	STA -5	STA -6
Rotenberger WMA Operations (EE5)	5/3/06				✓	✓	✓
Holey Land WMA Operations (DD)	3/26/08				✓	✓	
Pump Station G-404 Modification (II3)	9/24/08				✓		✓
EAA Storage Reservoirs Ph. 1 (G6)	**9/16/09**			✓(?)	✓	✓	✓
EAA Storage Reservoirs Ph. 2	9/17/14			✓(?)	✓	✓	✓
L-8 Basin (K Ph 1)	3/18/11	✓	✓				

CERP Projects in **Bold** were included in the initial project authorization in WRDA 2000. Completion dates taken from 7/27/2001 Update to CERP Master Implementation Schedule

2.0 GENERAL COMMENTS ON THE ALTERNATIVES

1. **Period of comparison.** To ensure valid comparisons among the alternatives for a specific basin, flows and phosphorus loads for each alternative will be estimated for a common period, from 12/31/2006 until 12/31/2056. This allows each alternative to consider the period prior to implementation of the relevant CERP project and the period after implementation of the relevant CERP project.

2. **Influence of source controls.** For the evaluation of alternatives, a sensitivity analysis will be performed to reflect varying degrees of phosphorus reduction due to source controls. For the EAA basins, it is anticipated that this sensitivity analysis will include a range of phosphorus load reductions compared to the Baseline data set. This would approximate between 25%-75% load reductions compared to the pre-BMP implementation period. For the non-EAA basins, the sensitivity analysis will include a range (0%-25%) of reductions in phosphorus loads compared to the Baseline data set. The influence of these reductions on the outflow phosphorus concentrations of the alternative will be calculated and summarized. It will be assumed that there will be no change in the Baseline flows associated with source controls. The evaluation of alternatives will not include any cost information on source controls.

3. **Planning level phosphorus discharge target.** A planning level target of 10 ppb is being used in the evaluation of alternatives. It has been suggested by external reviewers that the evaluation methodology include an additional planning level target for the basin discharge concentration other than 10 ppb, perhaps 20 ppb, to ensure that decision-makers realize that it may be infeasible to achieve 10 ppb. We feel that the formulation of the alternatives will yield a range of discharge concentrations, and all of them will be based on realistic, achievable performance (within the calibrated range of the DMSTA model), based on the best professional judgement of the staff and consultants involved. Hence, there is no need to have an additional target.

4. **Costs.** The evaluation will consider only incremental costs, i.e., in addition to costs already encumbered or budgeted to be spent, associated with specific alternatives. The costs associated with the first phase of the ECP will be considered sunk costs and will not be included. The evaluation will not include CERP project costs, as they should be the same among the alternatives for a specific basin.

5. **Influence of CERP Projects.** To estimate the influence of CERP projects on the flows to the STAs, a revised "Alt D13R" SFWMM simulation will be conducted that reflects the current configuration of the EAA Storage Reservoirs and refines the operations of the STAs. All other CERP projects will be modeled as they were in the original "Alt D13R". For the EAA Storage Reservoirs project, this revised simulation will represent a preliminary operational scenario for the reservoirs. This scenario may likely change during the development of the Project Implementation Report (PIR) for the EAA Storage Reservoirs project, however, the urgent time frame of these basin feasibility studies does not allow the opportunity to wait until after the PIR process finalizes the operational scenario. Any changes to the scenario used in these

feasibility studies resulting from the PIR process will be reflected in the subsequent engineering phases of the long-term water quality solutions.

6. **Phosphorus model.** The Dynamic Model for Stormwater Treatment Areas (DMSTA) will be used to estimate the phosphorus load reduction of the specific alternatives.

7. **Baseline Data Set.** The Baseline data set developed in a previous phase of the basin feasibility studies will serve as the basis for comparison of alternatives. DMSTA will be used to modify the baseline data set for all of the existing STAs, using current vegetation and configurations. Rough estimates of SAV partitioning in the existing STA cells (as of November 2001) are shown below. Note that percentages shown are not based on any empirical data but are based on Site Manager's field observations and best professional judgment. The balance of the STA cells will be treated as mostly emergent vegetation:

   STA1W (ENR) Cell 4: 70% Najas, 28% Ceratophyllum, 2% Hydrilla
   STA1W Cell 5: 50% Najas, 30% Ceratophyllum, 20% Hydrilla
   STA5 Cell 1B: 30% Najas, 30% Ceratophyllum, 40% Hydrilla
   STA2 Cell 3 (not including ca. 500 acres of former Brown's Farm):
   60% Najas, 30% Ceratophyllum, 10% Other

   - For a complete description of the Baseline data set and the methodology used to develop the Baseline data set, refer to *Baseline Data for the Basin-Specific Feasibility Studies to achieve the long-term Water Quality Goals for the Everglades*, May 2001.

8. **Optimizing STA Performance.** For each of the STAs, at least one alternative will evaluate improving performance within the existing footprint by incorporating an optimal combination of biological technologies. There is general consensus that an emergent vegetation cell is desirable at the front end of the STA to act as a nutrient "shock absorber". Based on preliminary research results, it also appears that some combination of submerged aquatic vegetation (SAV) and periphyton-based communities would be more effective at reducing phosphorus concentrations than a system containing only emergent vegetation. However, there is not yet any guidance on the optimum partitioning of these three vegetation communities within an STA. For the purpose of discussing preliminary alternatives, it was proposed to assign a 25%/50%/25% partitioning for emergent/SAV/periphyton. During the actual evaluation of alternatives (Task 4), this partitioning may likely be revised based on locations of existing levees, existing treatment cell vegetation and observed phosphorus removal performance. For example, STA-2 Cells 1 and 2 are dominated by emergent vegetation and have recently been achieving phosphorus concentrations of around 20 ppb. As more information becomes available during the course of the feasibility studies, these partitions would likely change. In any event, vegetation partitioning will be based on the Consultant's best professional judgment.

3.0 ALTERNATIVES FOR THE ECP BASINS

Alternative combinations of operational changes, basin-scale treatment and CERP projects for the ECP basins are presented in the following sections. Because the ECP basins discharge to STAs, the evaluation will be STA-specific, i.e., alternatives are presented for STA-1E, STA-1W, STA-2, STA-3/4, STA-5, and STA-6. Major components of the alternatives, along with probable influences on the flows and phosphorus loads to the STAs are briefly described in the following sections.

In addition to the alternatives, Baseline conditions utilizing the current configurations of the STAs will be simulated as a basis for comparison to the alternatives.

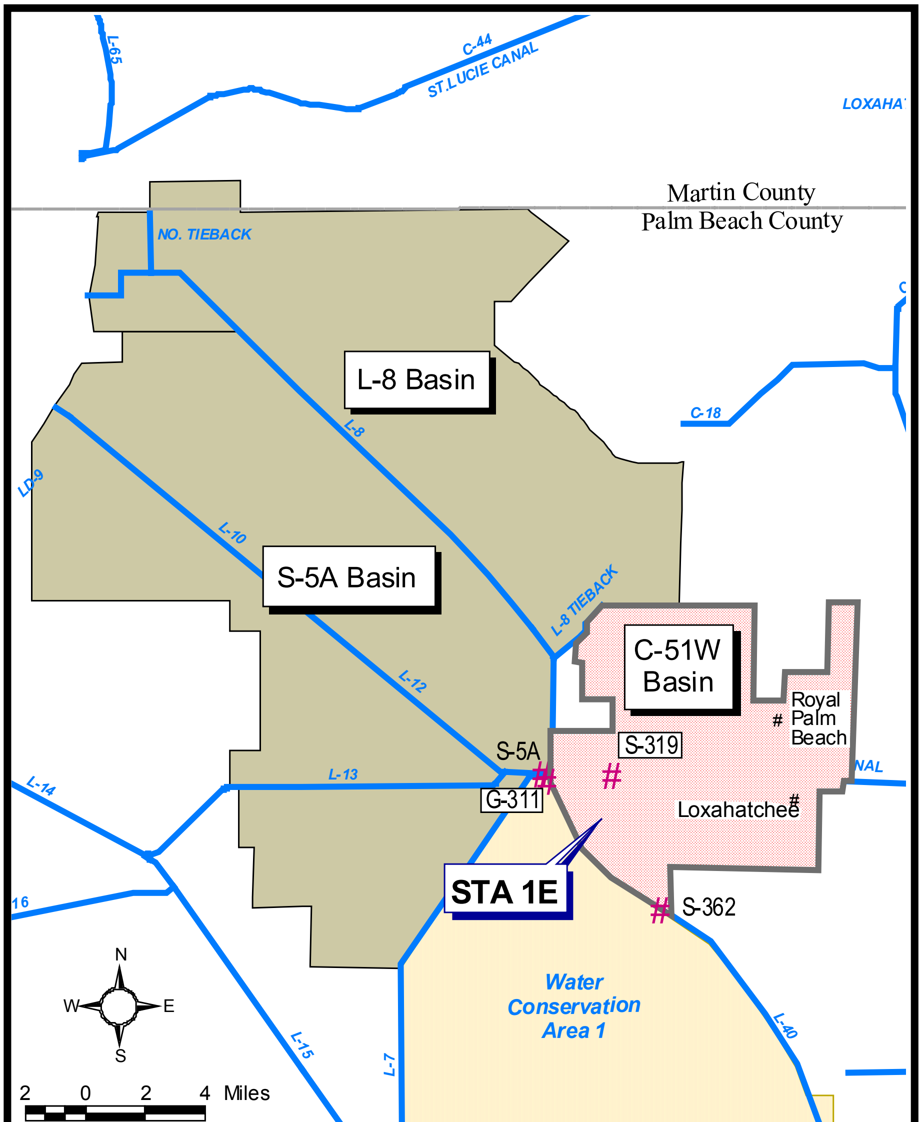
4.0 STA-1 EAST ALTERNATIVE COMBINATIONS

The C-51 West Basin has an area of 79.5 square miles and is located in eastern Palm Beach County. The project canals and water control structures in the basin have three primary functions: (1) to provide flood protection and drainage for the basin, (2) to pass through to tidewater, under certain conditions, discharges of flood flows from the L-8 Basin, and (3) to supply water to the basin during periods of low natural flow. C-51 is the primary canal in the C-51 West Basin. There are five project structures controlling flow in the basin: G-124, S-5AE, S-5AW, S-5AS, and S-5A.

The L-8 drainage basin is 171.2 square miles in area and is located in northwestern Palm Beach County and southwestern Martin County. The project canals and water control structures in the basin have four primary functions: (1) to protect the agricultural areas to the southwest of the L-8 basin by intercepting surface water flows originating in the L-8 basin; (2) to remove excess water from the L-8 Basin to storage in either Lake Okeechobee or Water Conservation Area 1(WCA 1); (3) to supply water from Lake Okeechobee or WCA 1 to the L-8 Basin for irrigation of agricultural lands; and (4) to transfer water from storage in WCA 1 to Lake Okeechobee. The project canals and water control structures in the basin have two secondary functions: (1) to supply water from the L-8 Basin, WCA 1 or Lake Okeechobee to the City of West Palm Beach water supply system and (2) to accept discharges of excess water from the City of West Palm Beach water supply system. There are three project canals in the L-8 Basin: (1) the L-8 borrow canal, (2) the North Tieback Levee borrow canal, and (3) the L-8 Tieback Levee borrow canal. There are seven project structures controlling flow in the L-8 Basin: S-5A, S-5AE, S-5AS, S-5AW, S-76, Culvert #10A, and an unnamed weir in the L-8 Tieback Levee borrow canal. The basins tributary to STA-1 East are presented in Figure 4-1. STA-1 East will treat stormwater flows from the C-51 West Basin, the S-5A Basin, at times the L-8 Canal Basin, and Lake Okeechobee releases during periods of high lake stages (if available treatment capacity exists in the treatment area). The Corps of Engineers is presently designing STA-1 East, and close coordination between the District and the Corps will continue into the design of long-term water quality solutions.

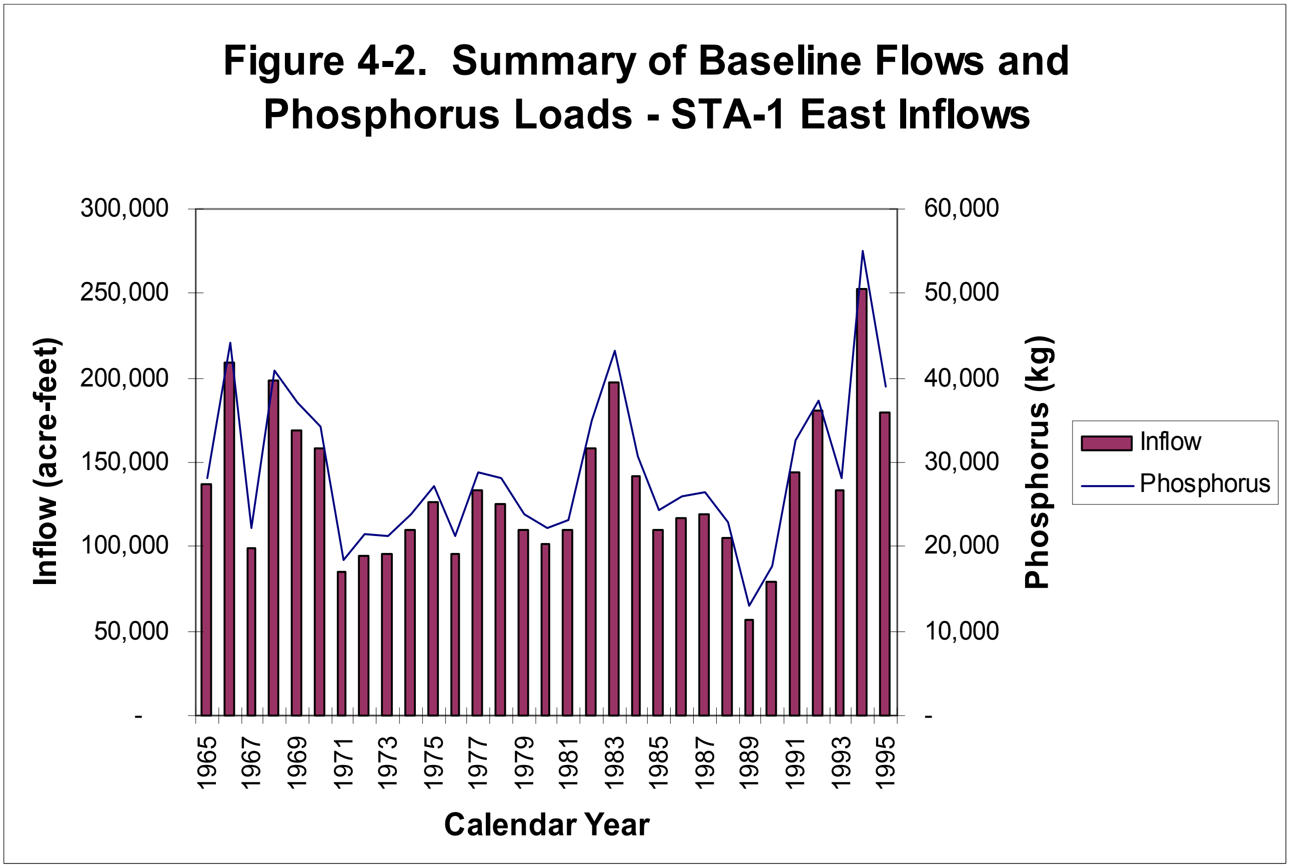
Note: The Baseline Flows and Phosphorus Loads shown in Figures 4-2 and 4-3 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For the water quality component, a regression relationship was developed between flow and phosphorus concentration. The resulting regression equation was applied to the simulated flows to create the 31-year period of Baseline flow and water quality data. Reference: *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

A schematic of STA-1 East is presented in Figure 4-4.



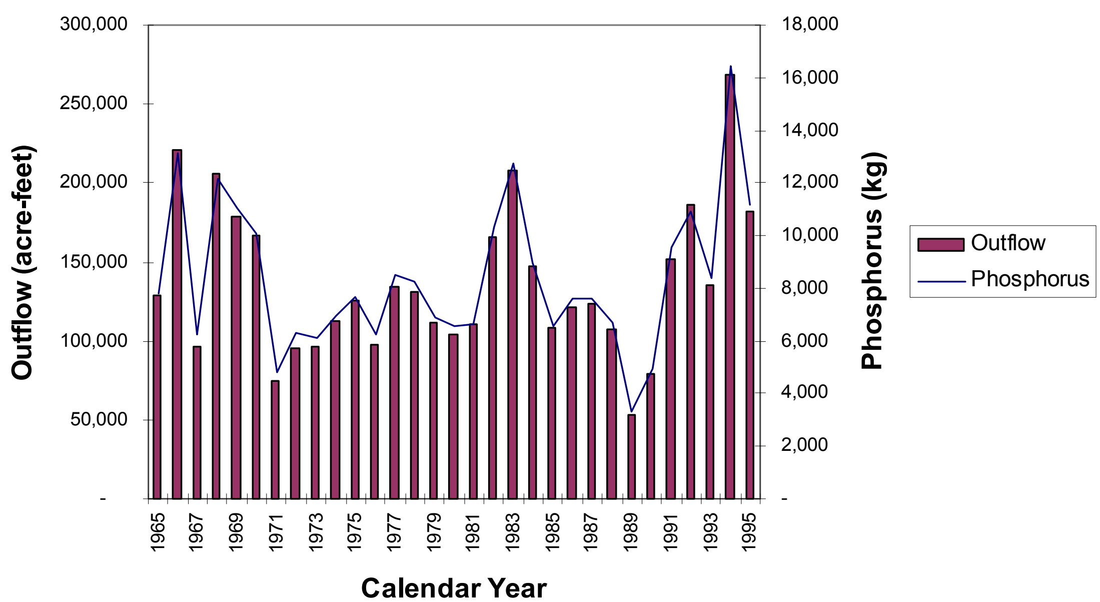
Tributary Basin Map - STA 1 East
Figure 4-1

ERRD/ESP CMIESSAU 20-JAN-2000 ecp-sta1e.apr ecp-sta1e-L



Notes:
1. A phosphorus concentration of 185 ppb was applied to the runoff from the C-51 West basin (Burns & McDonnell, 1994) and to the runoff from the Rustic Ranches subdivision.
2. A variable phosphorus concentration was applied to the runoff at S-5A/G-250, based on the daily regression analysis.
   For the S-5A basin dry season, the standard error of the estimate was 61.5 ppb, and for the wet season, the standard error of the estimate was 39.6 ppb.
3. A phosphorus concentration of 140 ppb was applied to the Lake releases, equal to the mean of the last ten years.

Figure 4-3. Summary of Baseline Flows and Phosphorus Loads - STA-1 East Outflows



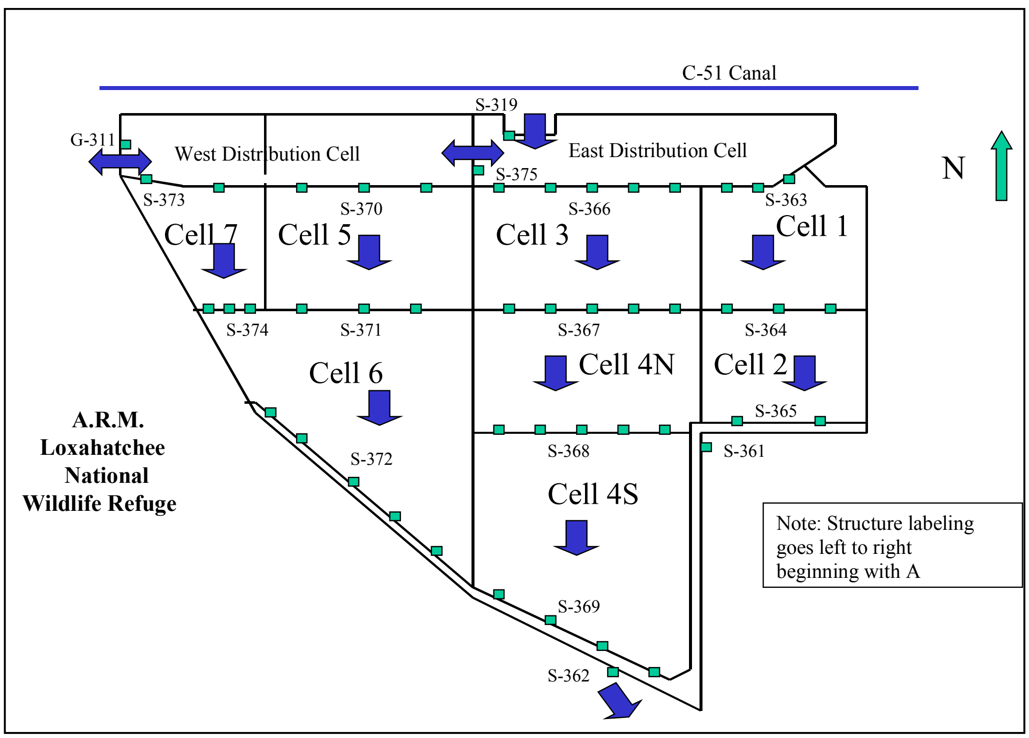


Figure 4-4. Schematic of STA 1 East (not to scale).

Alternative 1 – Optimize Performance of STA-1 East Within the Existing Footprint (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes retrofitting STA-1E to establish a composite biological treatment system within the footprint. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment. The partitioning for this alternative will also be based on currentknowledge of the Corps of Engineers plans for vegetation within STA-1E. This alternative may require the addition of 1-2 additional levees and 8-10 water control structures to achieve the optimal vegetation partition. There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:
A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:
A. **Source Control:** As part of the sensitivity analysis, the phosphorus load associated with the C-51 West Basin runoff going into STA-1E, as contained in the Baseline data set, will be reduced by 25%, and the influence that this reduction has on the outflow phosphorus concentration will be calculated and summarized. As part of the sensitivity analysis, the daily phosphorus loads associated with the S-5A basin runoff going into STA-1E will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed the optimized STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the reduced outflow concentration associated with the optimized STA.

Costs:
Basin-scale Treatment: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., will be required in order to retrofit STA-1E for this alternative.

Alternative 2 – If needed, expand STA-1E and STA-1W to Achieve the Planning Level Phosphorus Concentration (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes expanding STA-1E and STA-1W if needed to achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from a composite biological system. Vegetation partitioning will be based on Consultant's best professional judgment. The STA-1E expansion area will include the District owned 375 acres in Section 24 of Acme Basin A. There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells. Acquisition of additional lands will be required for this alternative, which will require acquisition of adjacent farms and/or homes.

Influence on Flow:
A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:
A. **Source Control:** As part of the sensitivity analysis, the phosphorus loads associated with the C-51 West Basin runoff going into STA-1E, as contained in the Baseline data set, will be reduced by 25%, and the daily phosphorus loads associated with the S-5A Basin runoff going into the STAs will be varied between 25%-75% compared to the pre-BMP implementation period. The influence that these reductions have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed the expanded STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:
Basin-scale Treatment: Additional land, levees, additional structures, higher levees, installation of limerock, additional O & M costs, etc., will be required in order to expand STA-1E for this alternative.

Alternative 3 – Expand STA-1E and STA-1W to Treat Runoff from Acme Basin B (12/31/2006 completion)

Description: This alternative is based on *Option 1 - STA 1 West "Bolt On"* as presented in the July 11, 2001 document titled *Basin B Water Quality Cleanup Options Opinion of Probable Cost*.

A. **Source Control**: It is assumed that stormwater Best Management Practices (BMPs), will be implemented in Acme Basin B by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls in the Acme Basin B runoff.

B. Basin-scale Treatment: This alternative is an incremental expansion of Alternative 2 above, and includes expanding the STA-1E footprint and the STA-1W footprint as needed to treat the Acme Basin B runoff and achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from a composite biological system. Vegetation partitioning will be based on Consultant's best professional judgment. In accordance with the current design of STA-1W and STA-1E, a portion of the runoff from the S-5A Basin (approximately 31,000 acre-feet per year) was to be treated in STA-1E and approximately 11,500 acre-feet per year of C-51W Basin runoff was to be treated in STA-1W. Under this alternative, STA-1W would be expanded to treat all of the S-5A Basin runoff to achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from a composite biological system. There may be some loss of capacity in the STAs in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:

A. Source Control: It is assumed that there will be no change in the Baseline flows associated with source controls.

B. Basin-scale Treatment: Baseline flows into STA-1E and STA-1W will be modified to include the Acme Basin B runoff and to reflect a revised cross-basin transfer to achieve the optimal performance in both STAs.

Influence on Water Quality:

A. Source Control: As part of the sensitivity analysis, the phosphorus loads associated with the C-51 West Basin runoff, as contained in the Baseline data set, will be reduced by 25%. Also as part of the sensitivity analysis, the phosphorus loads associated with the Acme Basin B runoff, as contained in the Baseline date set, will be reduced by 0% and 50%. Finally, the daily phosphorus loads associated with the S-5A Basin runoff going into the STAs will be varied between 25%-75% compared to the pre-BMP implementation period. The influence that these different loads have on the outflow phosphorus concentration will be calculated and summarized.

B. Basin-scale Treatment: Baseline loads into STA-1E and STA-1W will be modified to include the Acme Basin B runoff and to reflect a revised cross-basin transfer to achieve the optimal performance in both STAs. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:
Basin-scale Treatment: Additional land, levees, additional structures, higher levees, installation of limerock, additional O & M costs, etc., will be required in order to expand STA-1E and STA-1W for this alternative.

Alternative 4 – Modify STA-1E to Allow Diversion of the Runoff from Acme Basin B to STA-1E by 12/31/2006 then to the Palm Beach Aggregates Rock Pit by 2011.

Description: This alternative is based on *Option 2 – GKK Rock Pit/Adjacent STA* as presented in the July 11, 2001 document titled *Basin B Water Quality Cleanup Options Opinion of Probable Cost*.

A. **Source Control:** It is assumed that stormwater Best Management Practices (BMPs), will be implemented in Acme Basin B by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls in the Acme Basin B runoff.
B. **Basin-scale Treatment:** This alternative includes modifying STA-1E as needed to first allow diversion of the Acme Basin B runoff to STA-1E by 2006, then to allow diversion to the Palm Beach Aggregates rock pit by 2011, and optimizing the performance of STA-1E to achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from a composite biological system. Runoff from Acme Basin B will be diverted north to the C-51W Canal where it will combine with C-51W Basin runoff. Before 2011, this combined runoff will be captured and treated in STA-1E. After 2011, a portion of this combined runoff will be captured and treated in STA-1E; the balance will be conveyed west to the L-8 Canal and north to the Palm Beach Aggregates rock pit. There may be some loss of capacity in STA-1E in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells. Acquisition of additional lands, i.e., adjacent farms and/or homes, may be required for this alternative.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** Baseline flows into STA-1E will be modified as needed to allow diversion of Acme Basin B runoff to STA-1E by 2006 then to the Palm Beach Aggregates rock pit by 2011.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the phosphorus loads associated with the C-51 West Basin runoff, as contained in the Baseline data set, will be reduced by 25%. Also as part of the sensitivity analysis, the phosphorus loads associated with the Acme Basin B runoff, as contained in the Baseline date set, will be reduced by 0% and 50%. The influence that these different loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** Baseline loads into STA-1E will be modified as needed to allow diversion of Acme Basin B runoff to STA-1E by 2006 then to the Palm Beach Aggregates rock pit by 2011. DMSTA will be used by the Consultant to model the outflow concentration associated with the STA.

Costs:

Basin-scale Treatment: Additional land, levees, additional structures, higher levees, installation of limerock, additional O & M costs, etc., will be required in order to modify STA-1E and the structures in the C-51W canal (e.g., S-5AE) for this alternative. Additional costs may be required to allow diversion of runoff to the Palm Beach Aggregates rock pit.

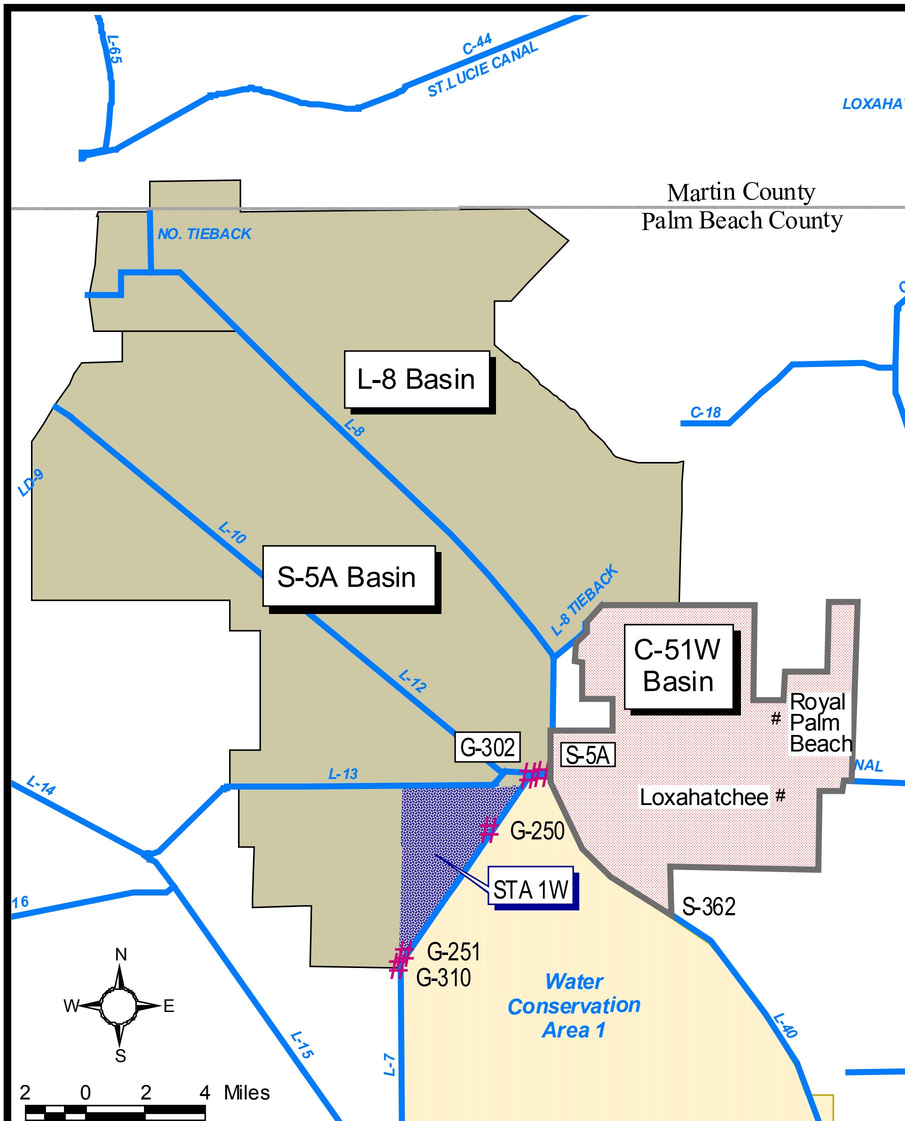
5.0 STA-1W ALTERNATIVE COMBINATIONS

The S-5A drainage basin is 194.3 square miles in area and is located in northwestern Palm Beach County. The project canals and water control structures in the S-5A Basin have four primary functions: (1) to remove excess water from the S-5A Basin to storage in Water Conservation Area 1 (WCA 1), and under some flood conditions, to storage in Lake Okeechobee; (2) to prevent over-drainage of the S-5A Basin; (3) to supply water from WCA 1, Lake Okeechobee, or the L-8 Basin to the S-5A Basin for irrigation; and (4) to provide conveyance for regulatory releases from Lake Okeechobee to WCA 1 and for water supply releases from the Lake to the C-51 Basin for municipal and agricultural use and to maintain the optimum canal water level to prevent saltwater intrusion. There are two project canals in the S-5A Basin: the L-10/L-12 and L-13 borrow canals. There are six project structures regulating flow in the S-5A Basin: S-5A, S-5AE, S-5AS, S-5AW, S-5AX, and S-352.

The basins tributary to STA-1 West are presented in Figure 5-1. STA-1 West will treat stormwater flows from the S-5A Basin, the East Beach Water Control District, the C-51 West Basin and at times the L-8 Canal Basin, as well as Lake Okeechobee releases during periods of high lake stages (if available treatment capacity exists in the treatment area).

Note: The Baseline Flows and Phosphorus Loads shown in Figures 5-5 and 5-6 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For the water quality component, a regression relationship was developed between flow and phosphorus concentration. The resulting regression equation was applied to the simulated flows to create the 31-year period of Baseline flow and water quality data. Reference: *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

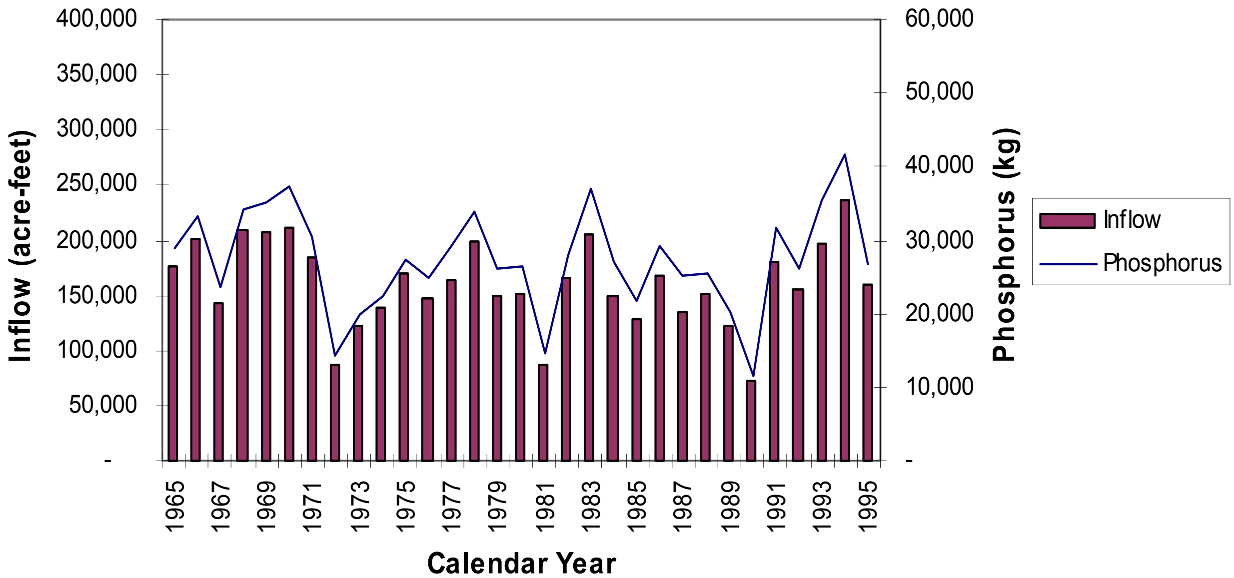
A schematic of STA-1 West is presented in Figure 5-7.



Tributary Basin Map - STA 1 West
Figure 5-1

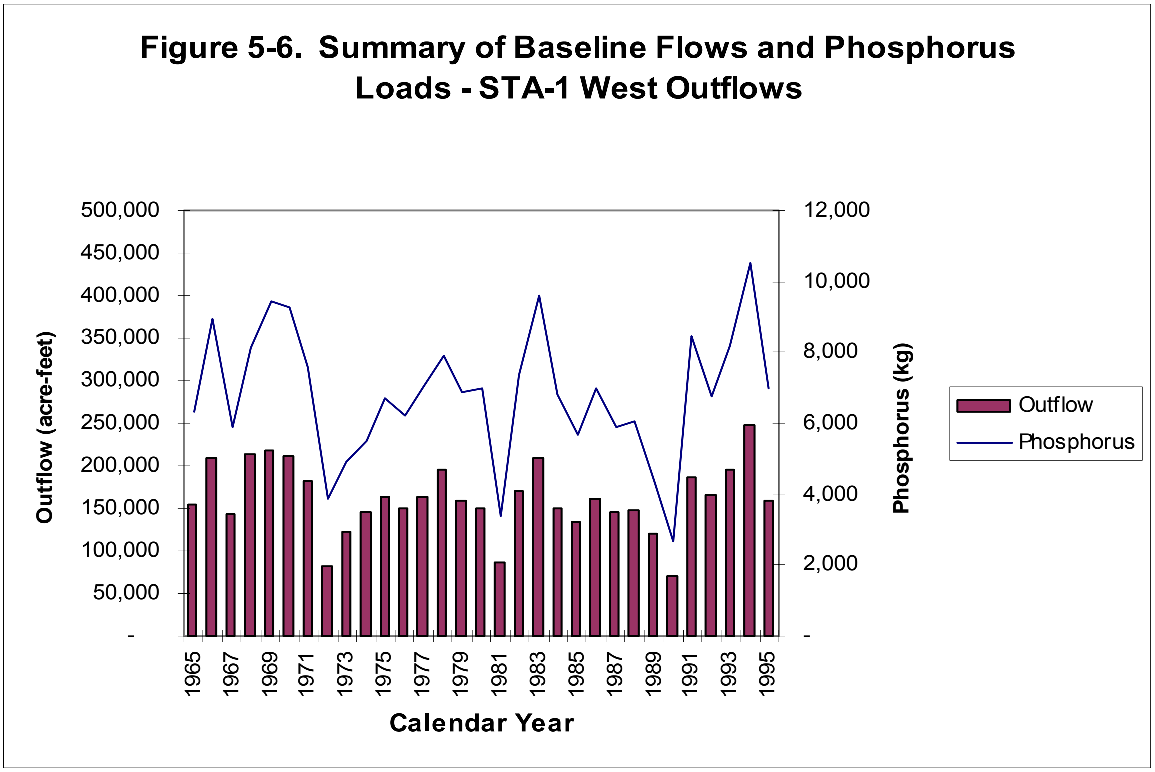
ERRD/ESP CMIESSAU REV. 21-JAN-2000 ecp-sta1w.apr ecp-sta1w-L

Figure 5-5. Summary of Baseline Flows and Phosphorus Loads - STA-1 West Inflows



Notes:

1. A phosphorus concentration of 140 ppb was applied to the Lake releases, equal to the mean of the last ten years.
2. A variable phosphorus concentration was applied to the runoff at S-5A/G-250, based on the daily regression analysis. For the S-5A basin dry season, the standard error of the estimate was 61.5 ppb, and for the wet season, the standard error of the estimate was 39.6 ppb.



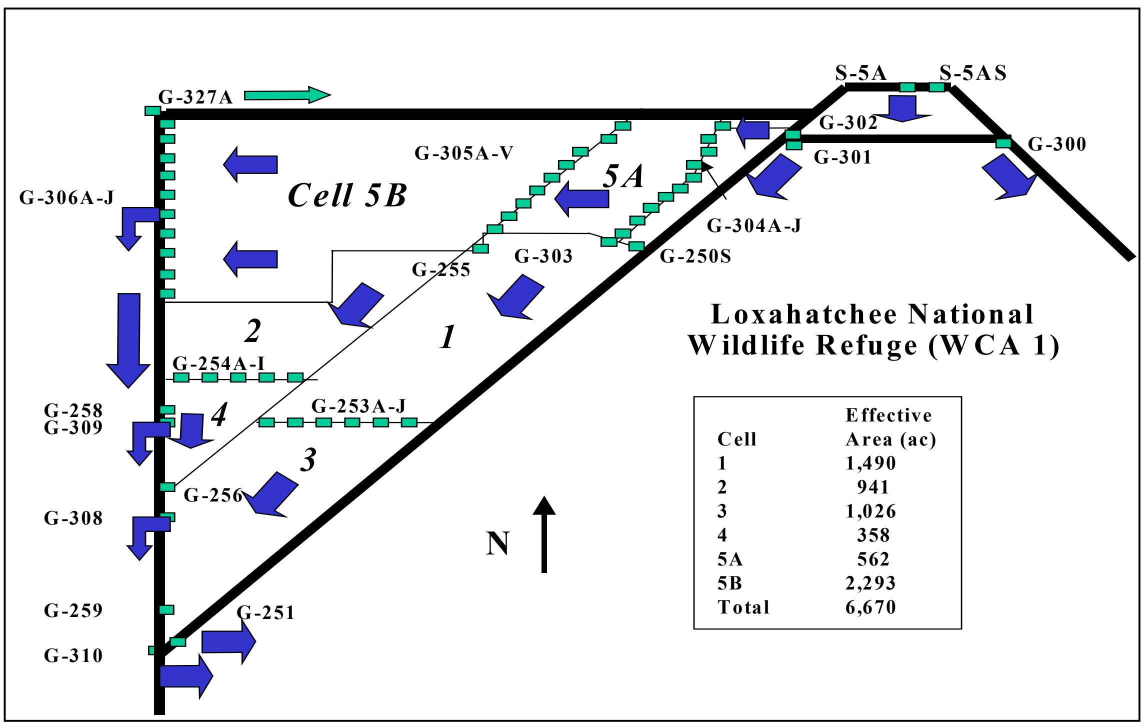


Figure 5-7. Schematic of STA-1 West (not to scale).

Alternative 1 – Optimize Performance of STA-1 West Within Existing Footprint (12/31/2006 completion)

Description:

A. Source Control: It is assumed that the 50% load reduction for the EAA basins reflected in the Baseline data set will be maintained.

B. Basin-scale Treatment: This alternative includes retrofitting STA-1W to establish a composite biological treatment system within the footprint. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.

B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:

A. Source Control: As part of the sensitivity analysis, the daily phosphorus loads associated with the S-5A basin runoff going into STA-1W will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.

B. Basin-scale Treatment: It is assumed the optimized STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the reduced outflow concentration associated with the optimized STA.

Costs:

Basin-scale Treatment: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., will be required in order to retrofit STA-1W for this alternative.

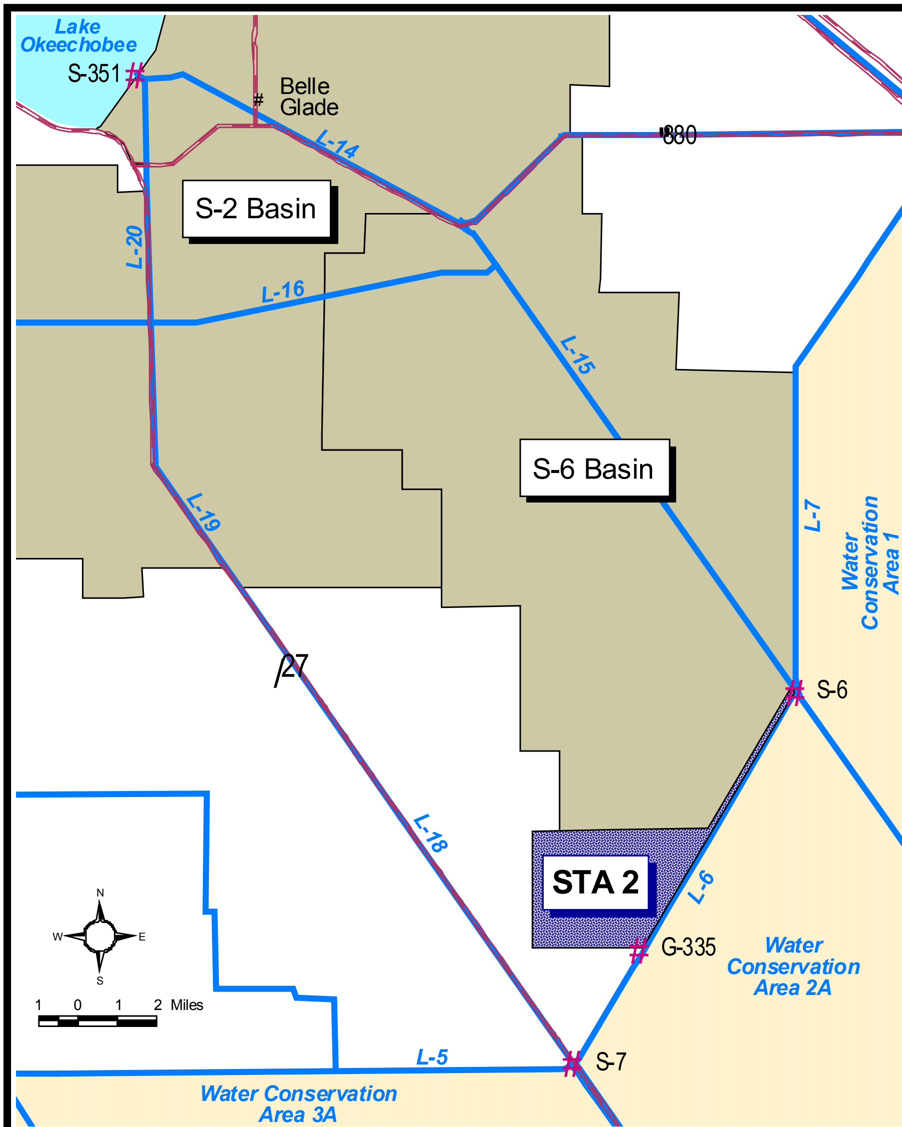
6.0 STA-2 ALTERNATIVE COMBINATIONS

The S-6 drainage basin is 132.8 square miles in area and is located in central Palm Beach County. The project canals and water control structures in the S-6 Basin have four primary functions: (1) to remove excess water from the S-6 Basin to storage in Water Conservation Area 1 (WCA 1); (2) to prevent over-drainage of the S-6 Basin; (3) to supply water from Lake Okeechobee to the S-6 Basin as needed for irrigation; and (4) to provide conveyance for regulatory releases from Lake Okeechobee to be passed to storage in WCA 1 and for water supply releases to be passed to eastern Palm Beach and Broward counties. There are two project canals in the S-6 Basin: the Hillsboro Canal and the L-6 borrow canal. Two other, non-project, canals are important in this basin. These are the Cross Canal and the Bolles Canal. The Cross Canal, the Bolles Canal, and the L-6 borrow canal are tributary to the Hillsboro Canal. There are four project structures affecting flows in the S-6 Basin: S-2, S-5AX, S-6, and S-351.

The basins tributary to STA-2 are presented in Figure 6-1. STA-2 will treat stormwater flows from the Hillsboro Canal Basin (S-6 Basin), the S-5A Basin, runoff from the Closter Farms, and East Shore Water Control District. In addition, S-6 will bypass Lake Okeechobee releases for downstream water supply and STA-2 will treat Lake releases during periods of high Lake stages (if available treatment capacity exists in the treatment area).

Note: The Baseline Flows and Phosphorus Loads shown in Figures 6-5 and 6-6 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For the water quality component, a regression relationship was developed between flow and phosphorus concentration. The resulting regression equation was applied to the simulated flows to create the 31-year period of Baseline flow and water quality data. Reference: *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

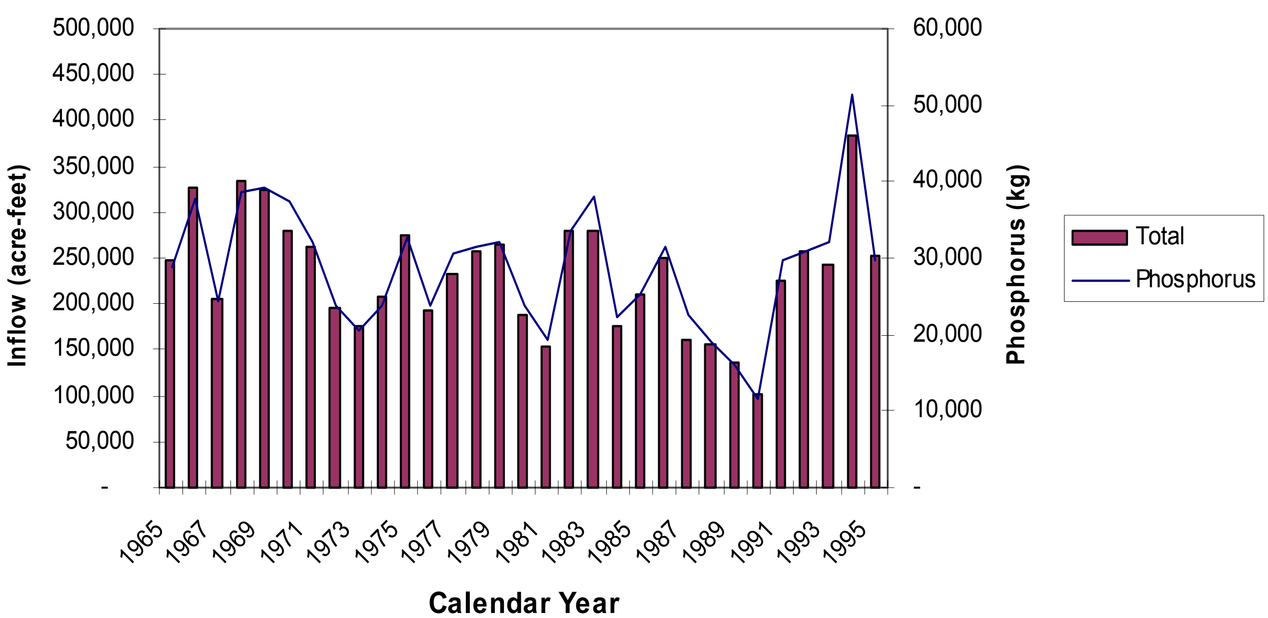
A schematic of STA-2 is presented in Figure 6-7.



Tributary Basin Map - STA 2
Figure 6-1

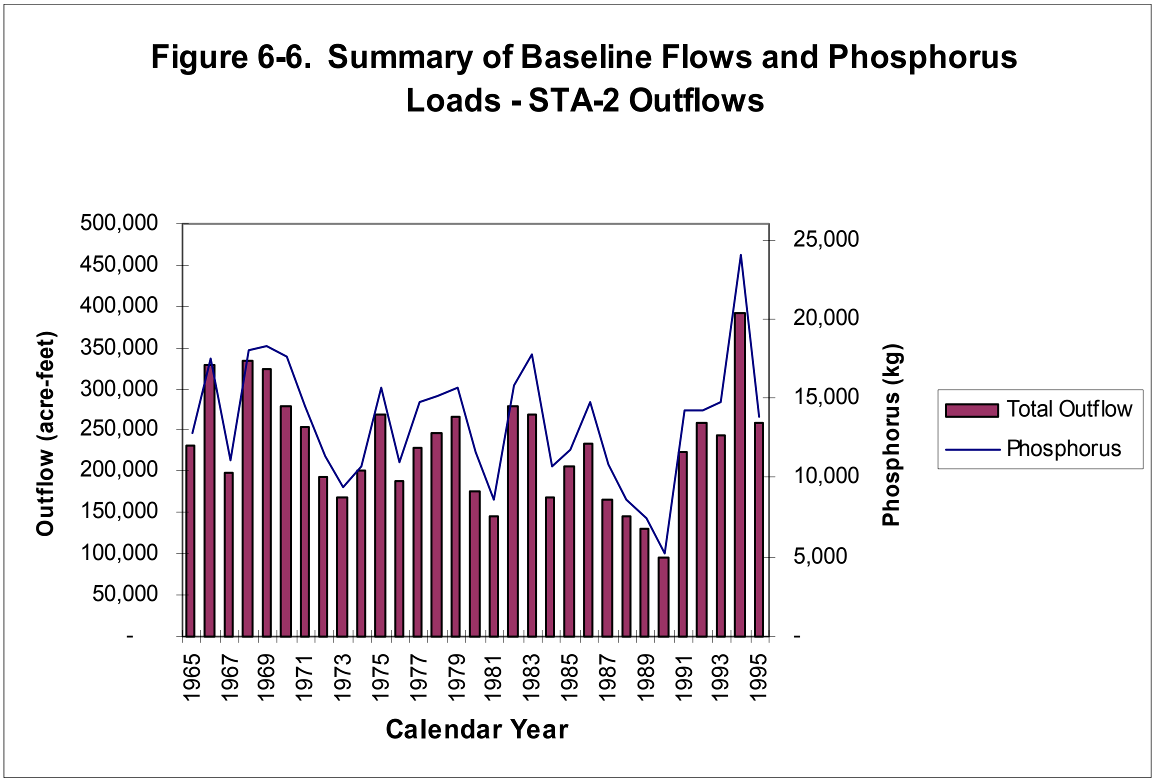
ERRD/ESP CMIESSAU 21-JAN-2000 ecp-sta2.apr ecp-sta2-L

Figure 6-5. Summary of Baseline Flows and Phosphorus Loads - STA-2 Inflows



Notes:

1. A variable phosphorus concentration was applied to the runoff from the S-5A basin, based on the daily regression analysis. For the dry season, the standard error of the estimate was 61.5 ppb, and for the wet season, the standard error of the estimate was 39.6 ppb.
2. A variable phosphorus concentration was applied to the runoff from the S-6 basin, based on the daily regression analysis. For the dry season, the standard error of the estimate was 36.2 ppb; for the wet season, the standard error was 31.1 ppb.
3. A phosphorus concentration of 206 ppb was applied to the Ch. 298 District's runoff (Burns & McDonnell, 1994).
4. A phosphorus concentration of 74 ppb was applied to the Lake releases, equal to the mean of the last ten years.



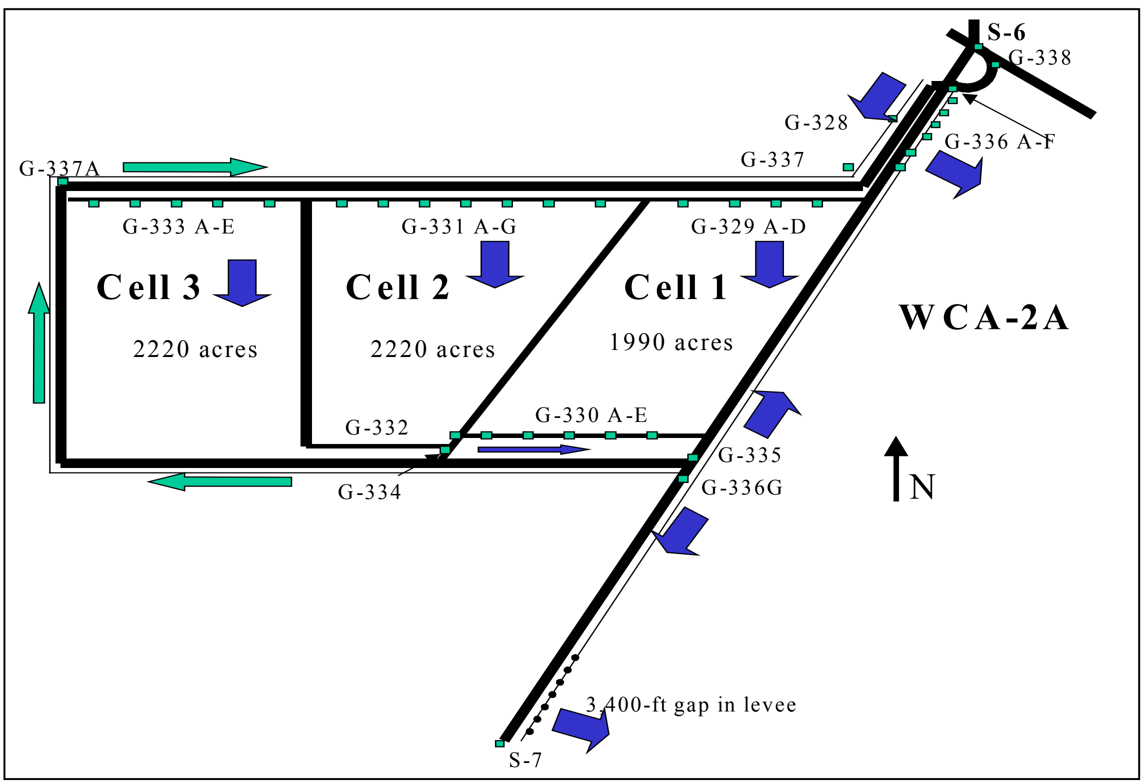


Figure 6-7. Schematic of STA-2 (not to scale).

Alternative 1 – Integrate with the EAA Storage Reservoirs CERP Project, If Practical (2014 completion)

Description:
Integrate with CERP Project: After the EAA Storage Reservoirs Project becomes operational, there may be an opportunity for exchange of water between STA-2 and the Eastern reservoir. This exchange may improve the performance of STA-2 compared to the Baseline condition.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline flows. After the EAA Storage Reservoirs Project becomes operational, there may be an opportunity for exchange of water between STA-2 and the Eastern reservoir.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline loads. If there is an exchange of water between STA-2 and the Eastern reservoir, this exchange may improve the performance of STA-2 compared to the Baseline condition. DMSTA will be used by the Consultant to model the outflow concentration associated with the STA.

Costs:
Integrate with CERP Project: There may be additional costs associated with this component to connect with the Eastern reservoir; there may also be savings in the STA-2 operations expenses due to reduced seepage control.

Alternative 2 – Optimize Performance of STA-2 Within Existing Footprint (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes retrofitting STA-2 to establish a composite biological treatment system within the footprint. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed the optimized STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the reduced outflow concentration associated with the optimized STA.

Costs:
Basin-scale Treatment: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., will be required in order to retrofit STA-2 for this alternative.

Alternative 3 – If needed, construct a Chemical Treatment Facility Within the Footprint of STA-2 (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes constructing a chemical treatment facility within the footprint of STA-2, if needed, by 12/31/2006. This would require conversion of a portion of STA-2 into a flow equalization basin, and the use of a portion of the existing STA-2 footprint for land disposal of residuals. While the CTSS final report recommends approximately 500 acres for a buffer marsh to increase alkalinity, data from test cell research suggests this post-treatment marsh may raise phosphorus levels above 10 ppb, and should be replaced with another process. The CTSS final report also recommends a post-treatment settling basin for capture of solids overflow but does not give specific guidance; the Consultant will need to determine this.

Influence on flows:
A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:
A. **Source Control:** As part of a sensitivity analysis, for the 6 ppb outflow case as described in the following paragraph, the phosphorus load associated with discharges from the EAA basin going to STA-2 (derived from the Baseline data set) will be varied between 25%-75% compared to the pre-BMP implementation period. The influence that this reduction has on the 50-year present worth cost estimate will be calculated and summarized. As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed that the chemical treatment facility will achieve a total phosphorus outflow concentration of 6 ppb for average flows and 10 ppb for peak flows. As part of a sensitivity analysis, the chemical treatment effluent will be assumed to be 8 ppb for average flows and 13 for peak flows and the influence these concentrations, and the resultant blending of treated and untreated flows, have on the 50-year present worth cost will be evaluated and summarized.

Costs:
Basin-scale Treatment: This alternative will have additional costs due to the retrofit of STA-2 to include a flow equalization basin, chemical treatment facility, and land disposal of residuals, along with all the associated infrastructure.

7.0 STA-3/4 ALTERNATIVE COMBINATIONS

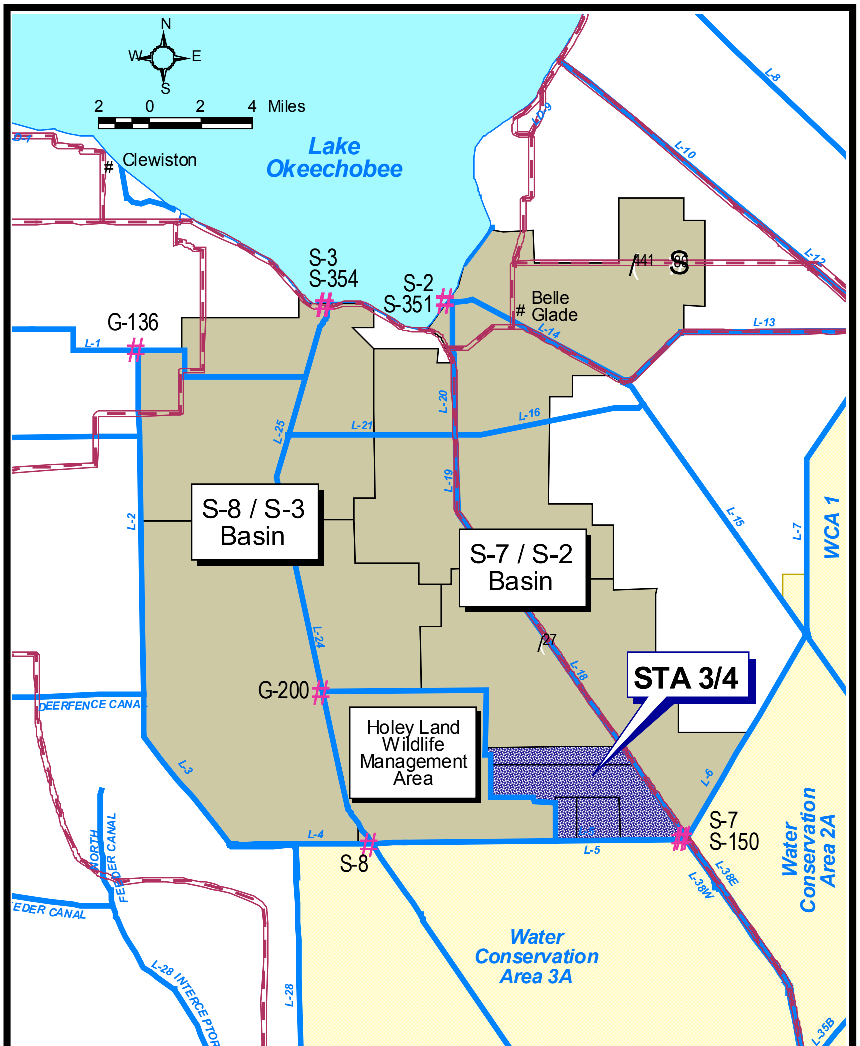
The S-7 drainage basin is 131.3 square miles in area and is located in south-central Palm Beach County. The project canals and water control structures in the S-7 Basin have four primary functions: (1) to remove excess water from the S-7 Basin to storage in Water Conservation Areas (WCAs) 2A and 3A; (2) to prevent over-drainage of the S-7 Basin; (3) to supply water from Lake Okeechobee to the S-7 Basin as needed for irrigation; and (4) to provide conveyance for regulatory releases from Lake Okeechobee to be passed to storage in WCAs 2A and 3A and for water supply releases to be passed to eastern Broward County. There are three project canals in the S-7 Basin: the North New River Canal, the L-6 borrow canal, and the L-5 borrow canal. There are four project structures affecting flow in the S-7 Basin: S-2, S-7, S-150, and S-351.

The S-8 drainage basin is 201.4 square miles in area and is located in southwestern Palm Beach County and in southeastern Hendry County. The project canals and water control structures in the S-8 Basin have five primary functions: (1) to remove excess water from the S-8 Basin to storage in Water Conservation Area 3A (WCA 3A); (2) to prevent over-drainage of the S-8 Basin; (3) to supply water from Lake Okeechobee to the S-8 Basin as needed for irrigation; (4) to provide conveyance for regulatory releases from Lake Okeechobee to storage in WCA 3A; and (5) to receive discharges of excess water from the L-3 borrow canal when these discharges will not cause flooding in the S-8 Basin. There are two project canals in the S-8 Basin: the Miami Canal and the L-4 borrow canal. There are four project structures affecting flow in the S-8 Basin: S-3, S-8, S-354, and G-88.

The basins tributary to STA-3/4 are presented in Figure 7-1. STA-3/4 will treat stormwater flows from the Miami Canal Basin, the North New River Canal Basin, as well as runoff from the South Shore Drainage District and South Florida Conservancy District. In addition, STA-3/4 will treat Lake Okeechobee regulatory releases if available treatment capacity exists in the treatment area.

Note: The Baseline Flows and Phosphorus Loads shown in Figures 7-8 and 7-9 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For the water quality component, a regression relationship was developed between flow and phosphorus concentration. The resulting regression equation was applied to the simulated flows to create the 31-year period of Baseline flow and water quality data. Reference: *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

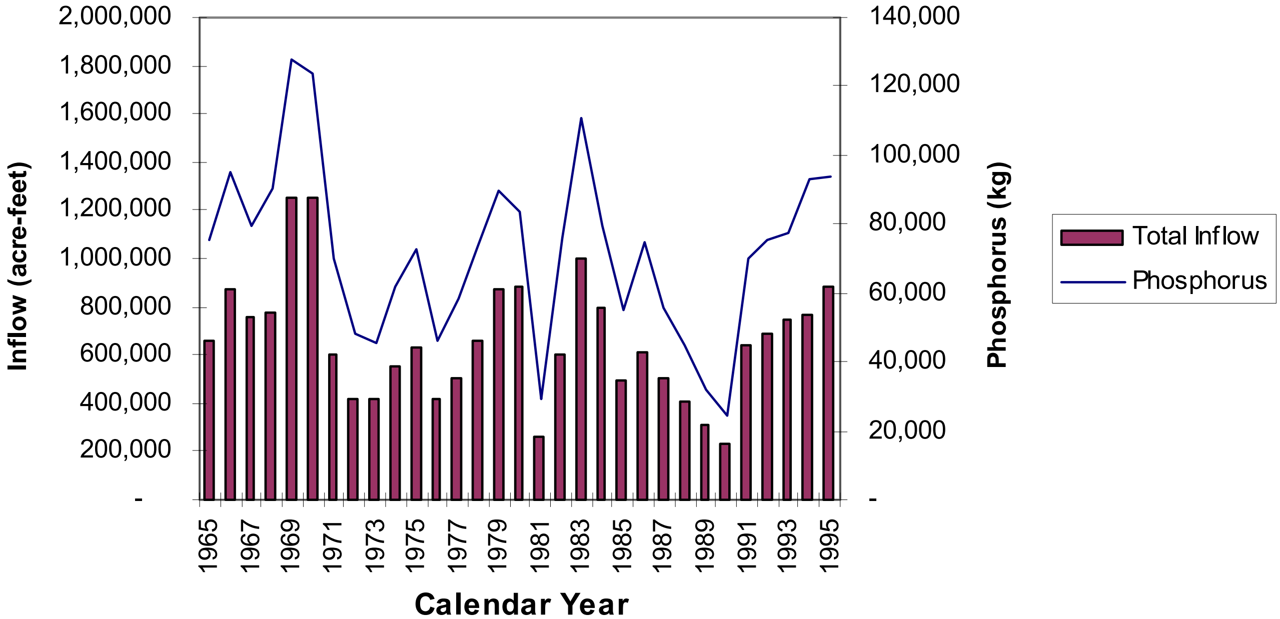
A schematic of STA-3/4 is presented in Figure 7-10.



Tributary Basin Map - STA 3/4
Figure 7-1

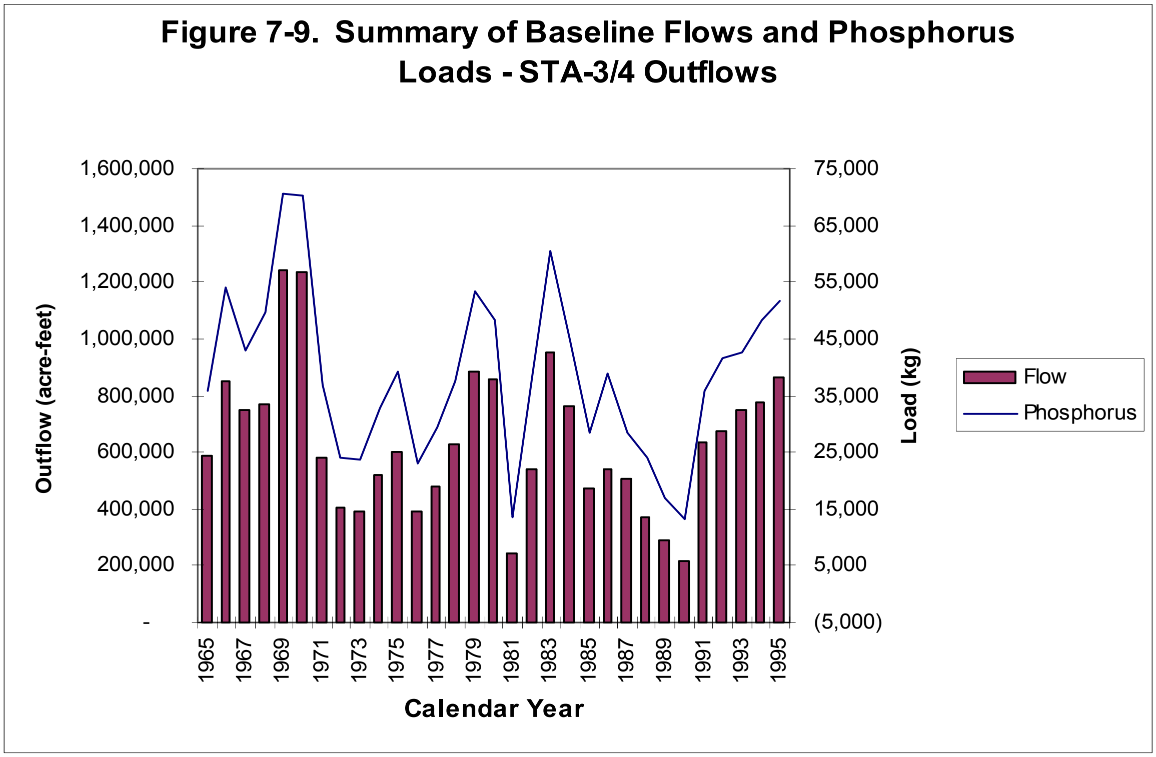
ERRD/ESP CMIESSAU REV. 04-JUN-2001 x:\ever-gis\ecp\aprfiles\ecp-sta3-4-cm1.apr ecp-sta3-4-L

Figure 7-8. Summary of Baseline Flows and Phosphorus Loads - STA-3/4 Inflows



Notes:

1. A variable phosphorus concentration was applied to the runoff from the S-8 basin, based on the daily regression analysis. For the dry season, the standard error of the estimate was 28.0 ppb; for the wet season, the standard error was 42.6 ppb.
2. A variable phosphorus concentration was applied to the runoff from the S-7 basin, based on the daily regression analysis. For the dry season, the standard error of the estimate was 42.6 ppb; for the wet season, the standard error was 27.0 ppb.
3. The 90-99 flow-weighted mean phosphorus concentration of 67 ppb was applied to Miami Canal Lake releases.
4. The 90-99 flow-weighted mean phosphorus concentration of 71 ppb was applied to the N. New River Canal Lake releases.
5. A phosphorus concentration of 100 ppb was applied to the Ch. 298 District's runoff (Burns & McDonnell, 1994).
6. A phosphorus concentration of 136 ppb was applied to the S-236 basin runoff (Burns & McDonnell, 1994).
7. A variable phosphorus concentration was applied to the G-136 flows, based on the regression analysis. For the dry season, the standard error of the estimate was 60.6 ppb; for the wet season, the standard error was 70.9 ppb.



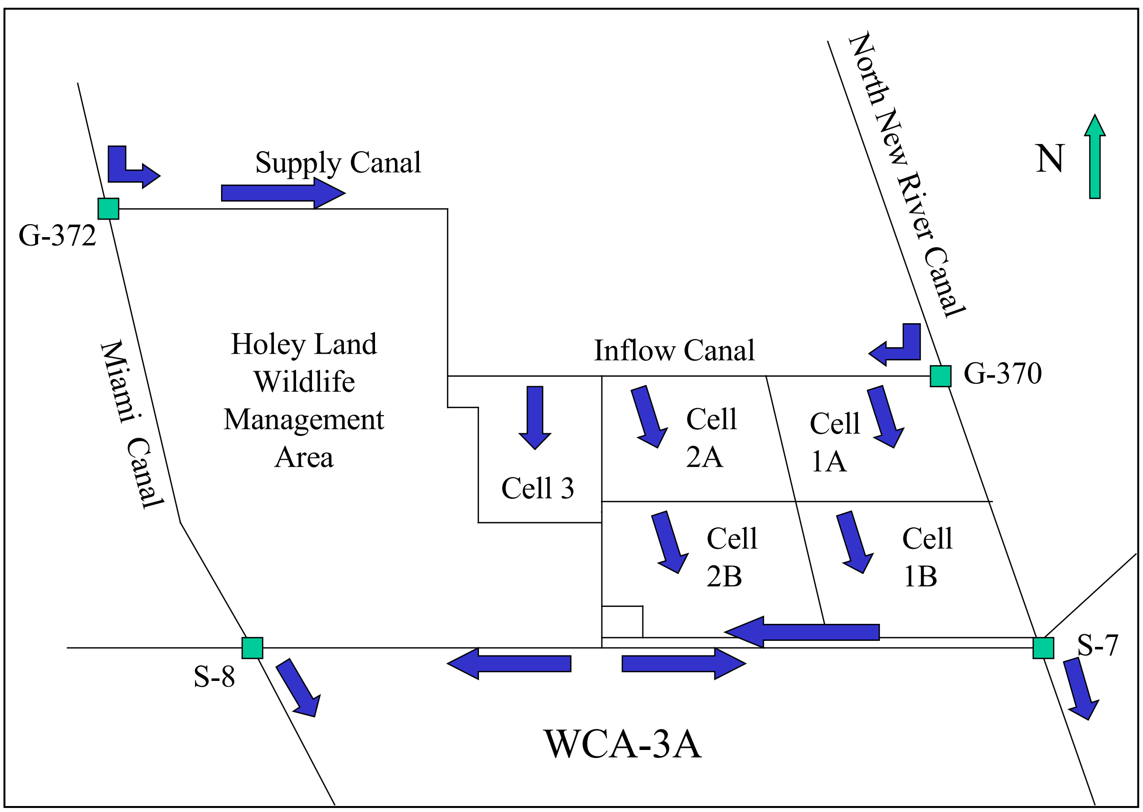


Figure 7-10. Schematic of STA-3/4 (not to scale).

Alternative 1 – Integrate with the EAA Storage Reservoirs CERP Project - Existing STA-3/4 through 2014 then Optimize the STA based on CERP Flows and Loads (2014 completion)

Description:
Integrate with CERP Project: This alternative includes retrofitting STA-3/4 by 2014 to establish a composite biological treatment system within the footprint. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:

A. **Source Control**: It is assumed that there will be no change in the Baseline flows associated with source controls.
B. Integrate with CERP Project: Prior to the CERP projects becoming operational, there will be no revision of the Baseline flows. After the EAA Storage Reservoirs Project becomes operational, there will be revised flows entering into STA-3/4. Other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-3/4.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline loads. After the EAA Storage Reservoirs Project becomes operational, there will be revised loads entering into STA-3/4. DMSTA will be used by the Consultant to model the reduced outflow concentration associated with the optimized STA.

Costs:
Integrate with CERP Project: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., will be required in order to retrofit STA-3/4 for this alternative.

Alternative 2 – Optimize Performance of STA-3/4 Within Existing Footprint (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes retrofitting STA-3/4 by 2006 to establish a composite biological treatment system within the footprint. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline flows. After the EAA Storage Reservoirs Project becomes operational, there will be revised flows entering into STA-3/4. Other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-3/4.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** Prior to the CERP project coming on line, the composite biological system should have better nutrient removal performance than the original STA, hence, the Baseline loads will be reduced for this alternative. After the CERP project comes on line, the Baseline loads will be revised to reflect the influence of the EAA Storage Reservoirs Project. DMSTA will be used by the Consultant to model the reduced outflow concentration associated with the optimized STA.

Costs:
Basin-scale Treatment: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., will be required in order to retrofit STA-3/4 for this alternative.

Alternative 3 – If needed, expand STA-3/4 to Achieve Planning Level Phosphorus Concentration (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes expanding STA-3/4 if needed to achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from an emergent/SAV composite biological system. Vegetation partitioning will be based on Consultant's best professional judgment. Acquisition of additional lands will be required for this alternative, which will require acquisition of adjacent farms and/or homes.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed the expanded STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:
Basin-scale Treatment: Additional land, levees, additional structures, higher levees, installation of limerock, additional O & M costs, etc., will be required in order to expand STA-1E for this alternative.

Alternative 4 – If needed, expand STA-3/4 to Achieve Lowest Sustainable TP Concentration (12/31/2006 completion)

Description:

Basin-scale Treatment: This alternative includes expanding STA-3/4 if needed to achieve the planning level discharge target (the lowest flow-weighted mean TP concentration of the calibrated data set or 10 ppb geometric mean) from an emergent/SAV/PSTA composite biological system. Vegetation partitioning will be based on Consultant's best professional judgment. Acquisition of additional lands will be required for this alternative, which will require acquisition of adjacent farms and/or homes. There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require either the addition of 0.5-2.0 feet of limerock, or removing the muck soil, for the PSTA cells.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** It is assumed that there will be no change in the Baseline flows associated with this alternative.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** It is assumed the expanded STA will achieve a reduced total phosphorus outflow concentration in discharges compared to the Baseline data set. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:

Basin-scale Treatment: Additional land, levees, additional structures, higher levees, installation of limerock, additional O & M costs, etc., will be required in order to expand STA-1E for this alternative.

STA-5 AND STA-6 ALTERNATIVE COMBINATIONS

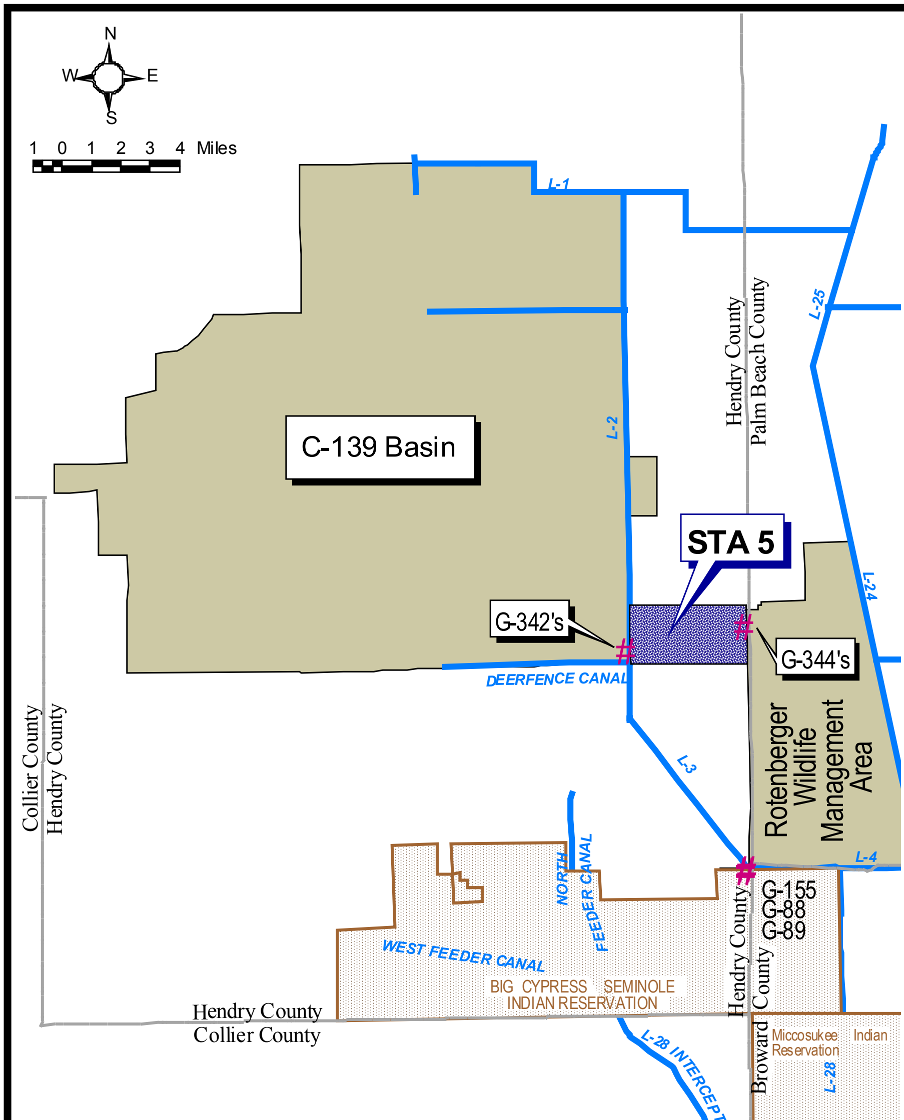
8.0 STA-5 (INCLUDING C-139 BASIN)

The C-139 Basin has an area of 168,437 acres and is located in Hendry County. The primary canals within the C-139 Basin are the L-1, L-2, and L-3 borrow canals. These canals were constructed in the 1950's primarily for fill material to construct the L-1, L-2, and L-3 levees. There are eight structures affecting flow in the C-139 Basin: G-150, G-151, G-152, G-135, G-136, G-88, G-89, and G-155. The majority of basin discharges south through the G-155, G-88 and G-89 structures. A portion of the basin discharges east through structure G-136 to the L-1 East Canal and on to the Miami Canal, where it flows south to S-8. The historic flows and loads for G-136 were included in the section on STA-3/4.

The basins tributary to STA-5 are presented in Figure 8-1. STA-5 will treat stormwater flows from the C-139 South Basin.

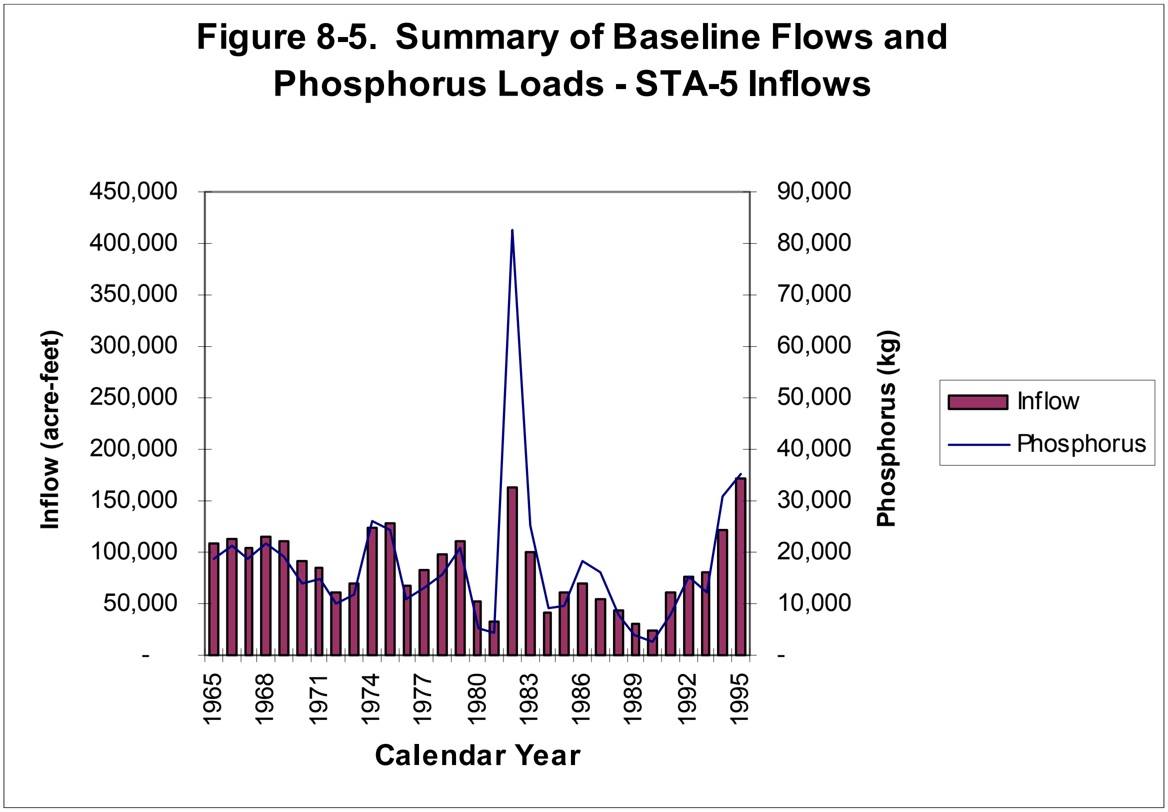
Note: The Baseline Flows and Phosphorus Loads shown in Figures 8-5 and 8-6 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For a complete description of the method used to develop the Baseline flow and water quality data set, refer to the report *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

A schematic of STA-5 is presented in Figure 8-7.



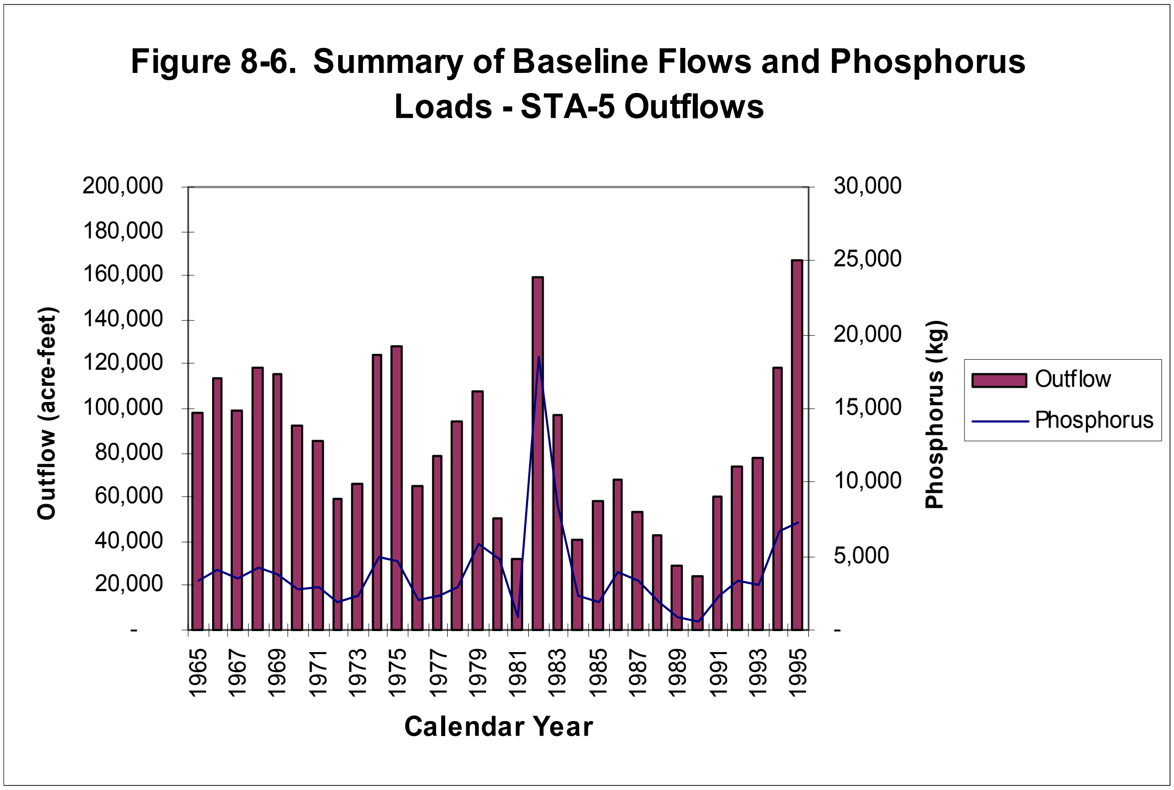
Tributary Basin Map - STA 5
Figure 8-1

ERRD/ESP CMIESSAU 21-JAN-2000 ecp-sta5.apr ecp-sta5-L



Notes:

1. A variable phosphorus concentration was applied to the C-139 basin runoff based on the daily regression analysis. For the dry season, the standard error of the estimate was 41.0 ppb; for the wet season, the standard error was 70.0 ppb.
2. The 1990-99 flow-weighted mean phosphorus concentration of 67 ppb was applied to Miami Canal Lake releases.



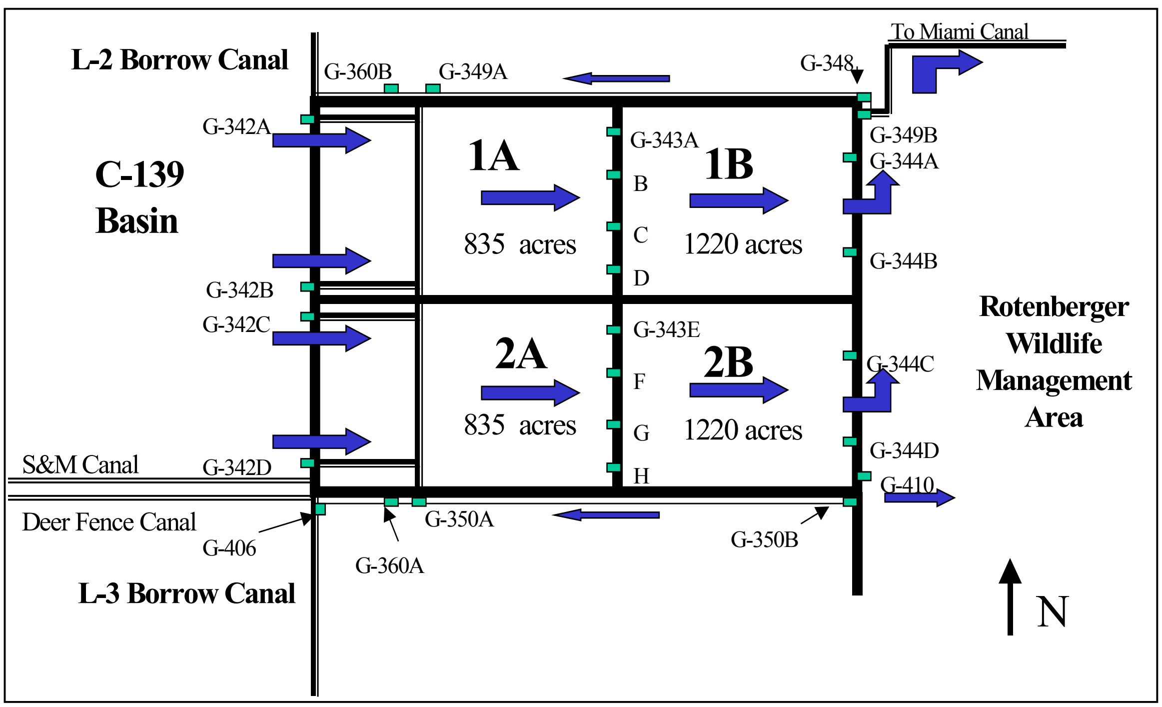


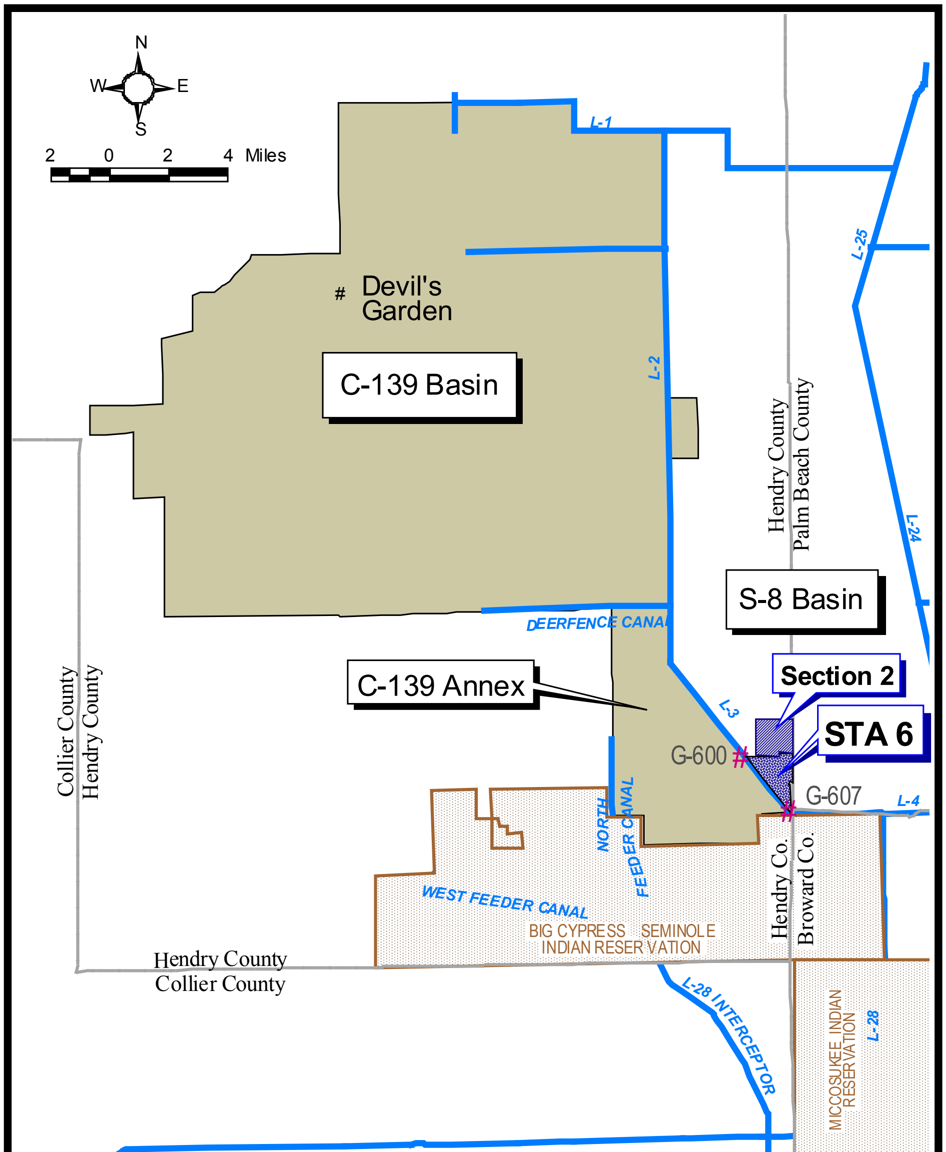
Figure 8-7. Schematic of STA-5 (not to scale).

9.0 STA-6

The basins tributary to STA-6 are presented in Figure 9-1. STA-6 Section 1 treats stormwater flows from approximately 10,000 acres north of the treatment area and south of STA-5 and west of the Rotenberger Wildlife Management Area. In the near future, STA-6 will be expanded to include approximately 1,400 additional acres for treatment of C-139 Basin and C-139 Annex flows.

Note: The Baseline Flows and Phosphorus Loads shown in Figures 9-5 and 9-6 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. For a complete description of the method used to develop the Baseline flow and water quality data set, refer to the report *Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades*, SFWMD, May 2001.

A schematic of STA-6 is presented in Figure 9-7.



Tributary Basin Map - STA 6
Figure 9-1

ERRD/ESP CMIESSAU 20-JAN-2000 ecp-sta6.apr ecp-sta6-L

Figure 9-5. Summary of Baseline Flows and Phosphorus Loads - STA-6 Inflows

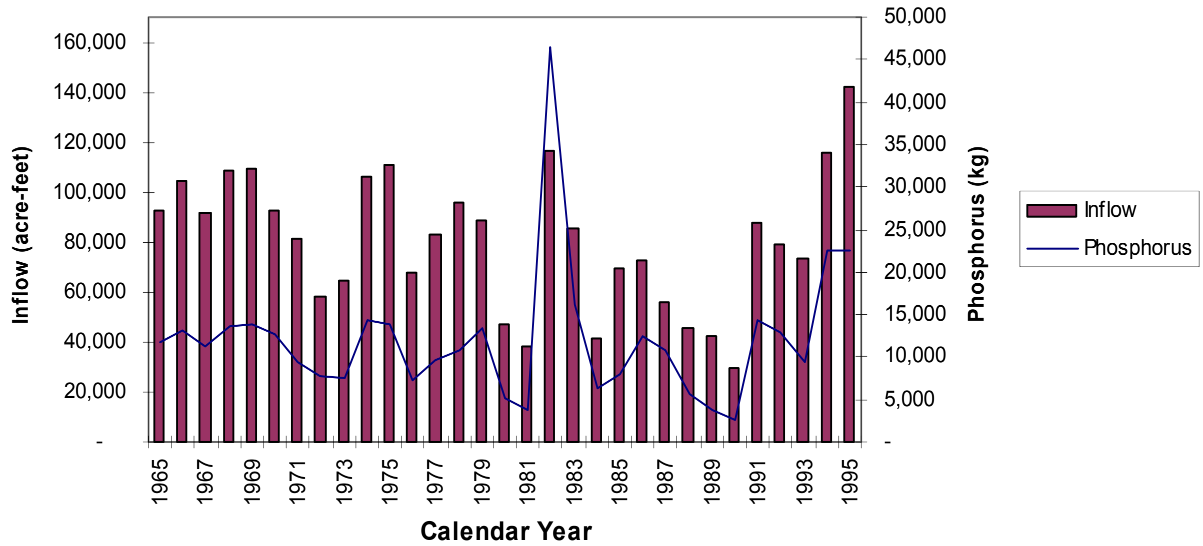
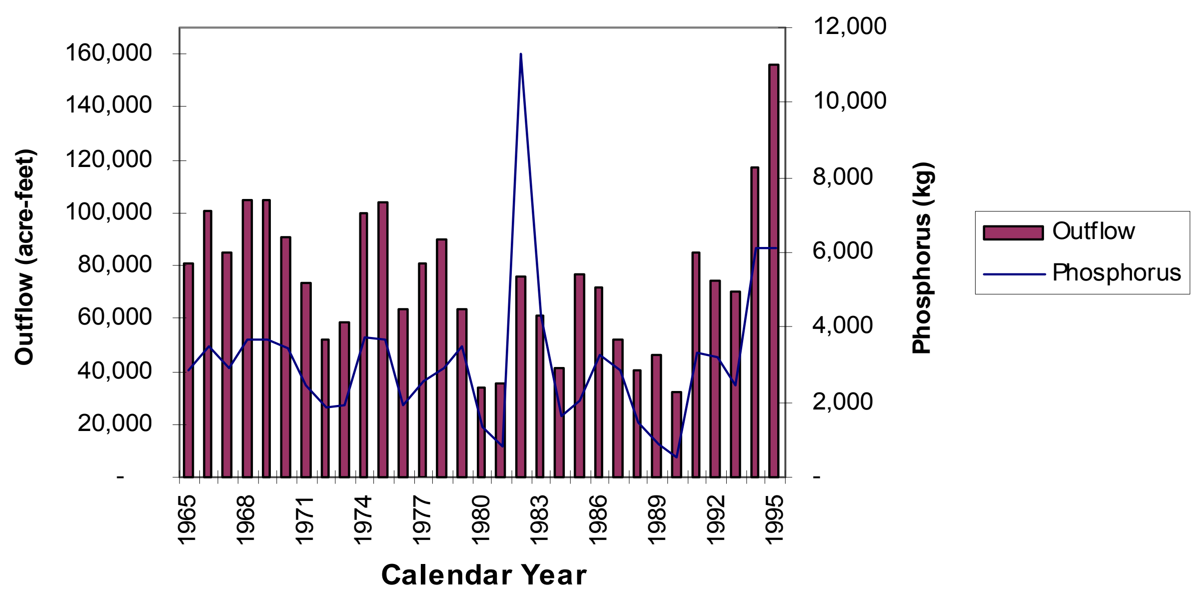


Figure 9-6. Summary of Baseline Flows and Phosphorus Loads - STA-6 Outflows



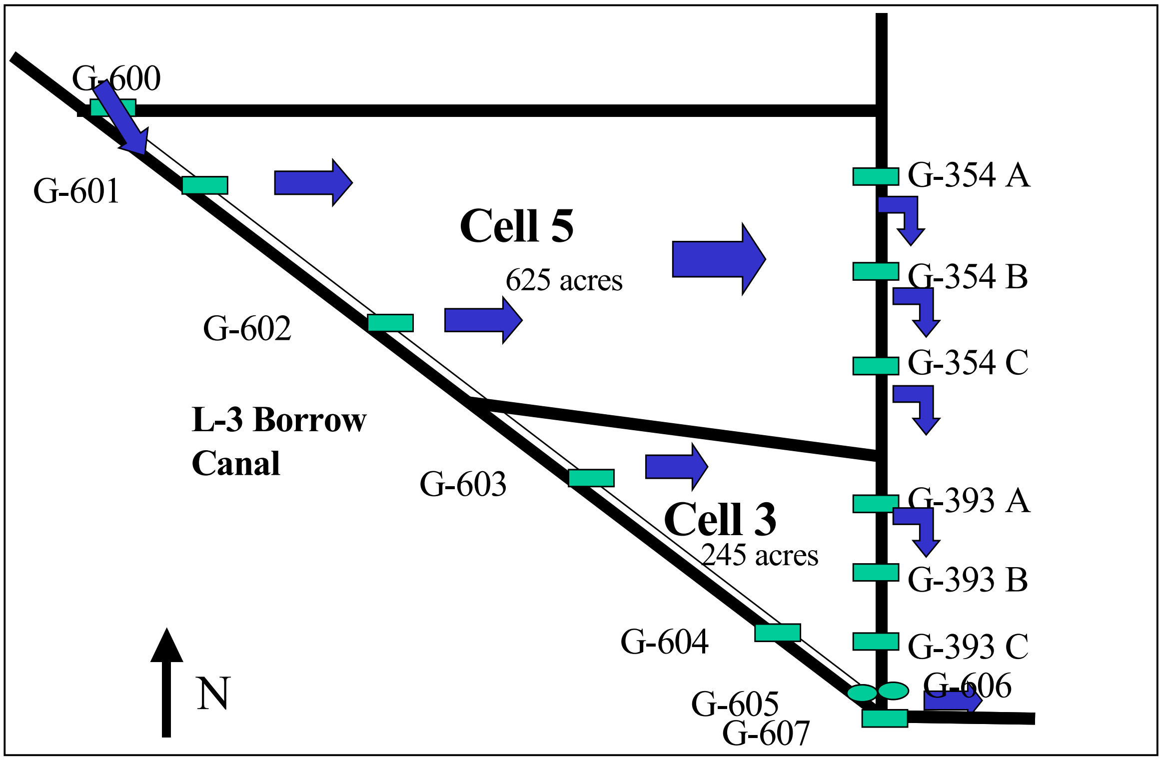


Figure 9-7. Schematic of STA-6 (not to scale).

Alternative 1. Existing STA-5 and STA-6 (Sec. 1 and 2) through 2014 then Optimize the STAs based on 2050wPROJ Simulation Flows and Loads (2014 completion)

Description:

Integrate with CERP Project: One portion of the EAA Storage Reservoirs Project is planned for the area between STA-5 and STA-6 by 2014. This alternative is based on the 2050wPROJ SFWMM simulation that was completed for the Basin Feasibility Studies. A description of the 2050wPROJ simulation can be found at http://www.sfwmd.gov/org/erd/bsfboard/memo_ecp15.pdf. Prior to 2014 when the Western Reservoir is proposed to be completed, STA-5 and STA-6 (Sections 1 and 2) will receive the baseline flows and loads. After 2014, for the purposes of this alternative, it is assumed that all C-139 Basin and C-139 Annex runoff will be sent to STA-5 and STA-6 for treatment and not first through the Western Reservoir. Lake releases would be sent to the Western Reservoir then through STA-6 for treatment prior to release to the WCA. This alternative will require some retrofits to STA-6 as needed to receive water from the reservoir. This alternative assumes that the entire current contributing watershed of STA-6 Section 1 (10,400 acres) will be converted to the Western Reservoir, including the area originally contemplated for STA-6 Section 2.

Influence on Flow:

A. **Source Control**: It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Integrate with CERP Project:** Before the Western Reservoir becomes operational, the STAs should receive the same flows as in the Baseline data set. After the CERP component is complete, the Western Reservoir will capture Lake releases then send them to STA-6 for final treatment, therefore, the STA-6 inflows may be altered significantly. Other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-5.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the phosphorus loads going into STA-5, as described in the Baseline data set, will be reduced by 25%. The daily phosphorus loads associated with the EAA basin runoff going into STA-6 will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline loads. After the EAA Storage Reservoirs Project comes on line, STA-6 will have revised loads compared to the Baseline. DMSTA will be used by the Consultant to model the reduced outflow concentrations associated with the optimized STAs.

Costs:

Integrate with CERP Project: This alternative assumes:

1. There should be no additional costs for the pump station for the C-139 Annex since it is included as part of the first phase of the ECP and it also should be offset by agricultural privilege tax revenues.
2. Retrofits of STA-6 to receive reservoir flows will be included as additional costs associated with this alternative.

Alternative 2 - Optimize Performance of STA-5 and STA-6 Within Existing Footprint, Including STA-6 Section 2 (12/31/2006 completion)

Description:
Basin-scale Treatment: This alternative includes retrofitting STA-5 and STA-6 to establish a composite biological treatment system within the footprint of the STAs. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and/or PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells. This alternative will also utilize results from the 2050wPROJ SFWMM simulation that was completed for the Basin Feasibility Studies. In this simulation, the EAA Western Reservoir discharges to STA-6, which would require retrofits to the existing STA. Construction of STA-6 Section 2 will be sized to the original 1470-acre footprint.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** Before the Western Reservoir becomes operational, the STAs should receive the same flows as in the Baseline data set. After the CERP component is complete, the Western Reservoir will capture Lake releases then send them to STA-6 for final treatment, therefore, the STA-6 inflows may be altered significantly. Other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-5.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the phosphorus loads going into STA-5, as described in the Baseline data set, will be reduced by 25%. The daily phosphorus loads associated with the EAA basin runoff going into STA-6 will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Basin-scale Treatment:** Prior to the CERP project coming on line, the composite biological system should have better nutrient removal performance than the original STAs, hence the Baseline loads will be reduced for this alternative. After the EAA Storage Reservoirs Project comes on line, STA-6 will have revised loads compared to the Baseline. DMSTA will be used by the Consultant to model the reduced outflow concentrations associated with the optimized STAs.

Costs:
Basin-scale Treatment: Additional levees, additional structures, higher levees, installation of limerock, and additional O & M costs, etc., may be required in order to retrofit the STAs for this alternative. Retrofits of STA-6 to receive Western Reservoir flows will be included as additional costs associated with this alternative.

Alternative 3 – Expand Footprint of STA-5 by Approximately 500 acres to Achieve Lowest Sustainable TP by 12/31/2006

Description:
Basin-scale Treatment: This alternative includes expanding STA-5 footprint by approximately 500 acres to achieve better phosphorus treatment than currently exists, and establishing a composite vegetation system within the STA. This composite system would generally consist of emergent vegetation, submerged aquatic vegetation (SAV) and PSTA, partitioned based on the Consultant's best professional judgment, in consideration of existing levee locations, with possible addition of levees and water control structures (to be refined better during the evaluation process). New inflow pump stations would be required, and this would also make available an additional 1,000 +/- acres along the western boundary of STA-5 that is presently too high in elevation to be effective treatment area. STA-6 Section 2 would be sized as needed to capture and treat any runoff during the 31-year simulated period that may bypass the expanded STA-5. There may be some loss of capacity in meeting PSTA hydraulic constraints, and therefore in order to avoid bypass, may have to build higher levees to hold water in upstream cells at higher stages. Based on preliminary PSTA research results, this alternative may require the addition of 0.5-2.0 feet of limerock for the PSTA cells. This alternative will also utilize results from the 2050wPROJ SFWMM simulation that was completed for the Basin Feasibility Studies. In this simulation, the EAA Western Reservoir discharges to STA-6, which would require retrofits to the existing STA.

Influence on Flows:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Basin-scale Treatment:** Before the reservoir becomes operational, the STA(s) should receive reduced flows due to the conversion of 500 acres of tributary land to the STA, hence, the Baseline data set flows will be reduced for this alternative. After the CERP component is complete, the Western Reservoir will capture Lake releases then send them to STA-6 for final treatment, therefore, the STA-6 inflows may be altered significantly. The EAA Western Reservoir, other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-5.

Influence on Water Quality:

A. Source Control: As part of the sensitivity analysis, the phosphorus loads going into STA-5, as described in the Baseline data set, will be reduced by 25%. As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into STA-6 will be varied between 25%-75% compared to the pre-BMP implementation period, and the influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.

B. Basin-scale Treatment: Prior to the reservoir becoming operational, there would be a reduction in phosphorus loads to the STA(s) due to the reduced watershed resulting from expansion of the treatment area and the composite biological system should have better nutrient removal performance than the original STA(s); hence, the Baseline data set would be adjusted for this alternative. After the EAA Storage Reservoirs Project comes on line, STA-6 will have revised loads compared to the Baseline. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:
Basin-scale Treatment: Additional land, levees, structures, etc. will be required in order to retrofit the STAs for this alternative, including retrofits of STA-6 to receive Western Reservoir flows and retrofits of STA-5.

Alternative 4. Existing STA-5 and STA-6 (Sec. 1 and 2) through 2014 then Optimize the STAs based on Modified-2050wPROJ Simulation Flows and Loads

(2014 completion)

Description:
Integrate with CERP Project: This is a modification of Alternative 1 and the assumptions used to develop the 2050wPROJ simulation. Prior to 2014 when the Western Reservoir is proposed to be completed, STA-5 and STA-6 (Sections 1 and 2) will receive the baseline flows and loads. After 2014, for the purposes of this alternative, it is assumed that the Western Reservoir will capture all C-139 Basin and C-139 Annex runoff, then send it to STA-5 and STA-6 for final treatment. It is understood that this capture of C-139 Basin runoff was not contemplated during the development of the 1999 Restudy, however, at that time there was no defined land acquisition associated with the project. Now that the area between STA-5 and STA-6 has been made available, it is prudent to consider integrating the Western Reservoir with these treatment areas. Lake releases would also be sent to the Western Reservoir then through STA-5 and STA-6 for treatment prior to release. This alternative will require some retrofits to STA-5 and STA-6 as needed to receive water from the Western Reservoir. This alternative assumes that the entire current contributing watershed of STA-6 Section 1 (10,400 acres) will be converted to the Western Reservoir, including the area originally contemplated for STA-6 Section 2.

Influence on Flow:

A. **Source Control**: It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Integrate with CERP Project:** Before the reservoir becomes operational, the STAs should receive the same flows as in the Baseline data set. After the Western Reservoir becomes operational, flows may be altered significantly. The Western Reservoir will capture all C-139 Basin and C-139 Annex runoff first, as well as Lake releases, then send the water to STA-5 and STA-6 for final treatment. Other CERP projects, operational modifications to the Holey Land and Rotenberger Wildlife Management Areas and modifications to the G-404 pump station, may influence discharges from STA-5.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the phosphorus loads from C-139 going into the Western Reservoir, then into STA-5 and STA-6, as described in the Baseline data set, will be reduced by 25%. The influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline loads. After the EAA Storage Reservoirs Project comes on line, STA-5 and STA-6 will have revised loads compared to the Baseline. DMSTA will be used by the Consultant to model the outflow concentrations associated with the STAs.

Costs:

Integrate with CERP Project: This alternative assumes:

1. There should be no additional costs for the pump station for the C-139 Annex since it is included as part of the first phase of the ECP and it also should be offset by agricultural privilege tax revenues.
2. Retrofits of STA-5 and STA-6 to receive reservoir flows will be included as additional costs associated with this alternative.

10.0 INTEGRATED STAs

Alternative 1 – Integrate the STAs and the EAA Storage Reservoirs CERP Project (2014 completion)

Description:
Integrate with CERP Project: This alternative will be defined after the preliminary evaluations are performed for each of the STAs. This alternative will consider optimization and integration of the STAs and the Reservoirs to achieve the optimal performance in the STAs as a group.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline flows. After the EAA Storage Reservoirs Project becomes operational, there may be revised inflows for one or more of the STAs.

Influence on Water Quality:

A. **Source Control:** As part of the sensitivity analysis, the daily phosphorus loads associated with the EAA basin runoff going into the STA will be varied between 25%-75% compared to the pre-BMP implementation period. The phosphorus loads from the C-139 Basin, as described in the Baseline data set, will be reduced by 25%. Also, the phosphorus load associated with the C-51 West Basin runoff going into STA-1E, as contained in the Baseline data set, will be reduced by 25%. The influence that these loads have on the outflow phosphorus concentration will be calculated and summarized.
B. **Integrate with CERP Project:** Prior to the CERP projects becoming operational, there will be no revision of the Baseline loads. After the EAA Storage Reservoirs Project becomes operational, there may be revised inflow loads for one or more of the STAs. DMSTA will be used by the Consultant to model the outflow concentration associated with the STAs.

Costs:
Integrate with CERP Project: There may be additional costs associated with this alternative. These costs will be estimated after this alternative is defined.

11.0 SUMMARY OF THE ECP BASIN ALTERNATIVES

Figure 8. Summary of ECP Basin Alternatives.

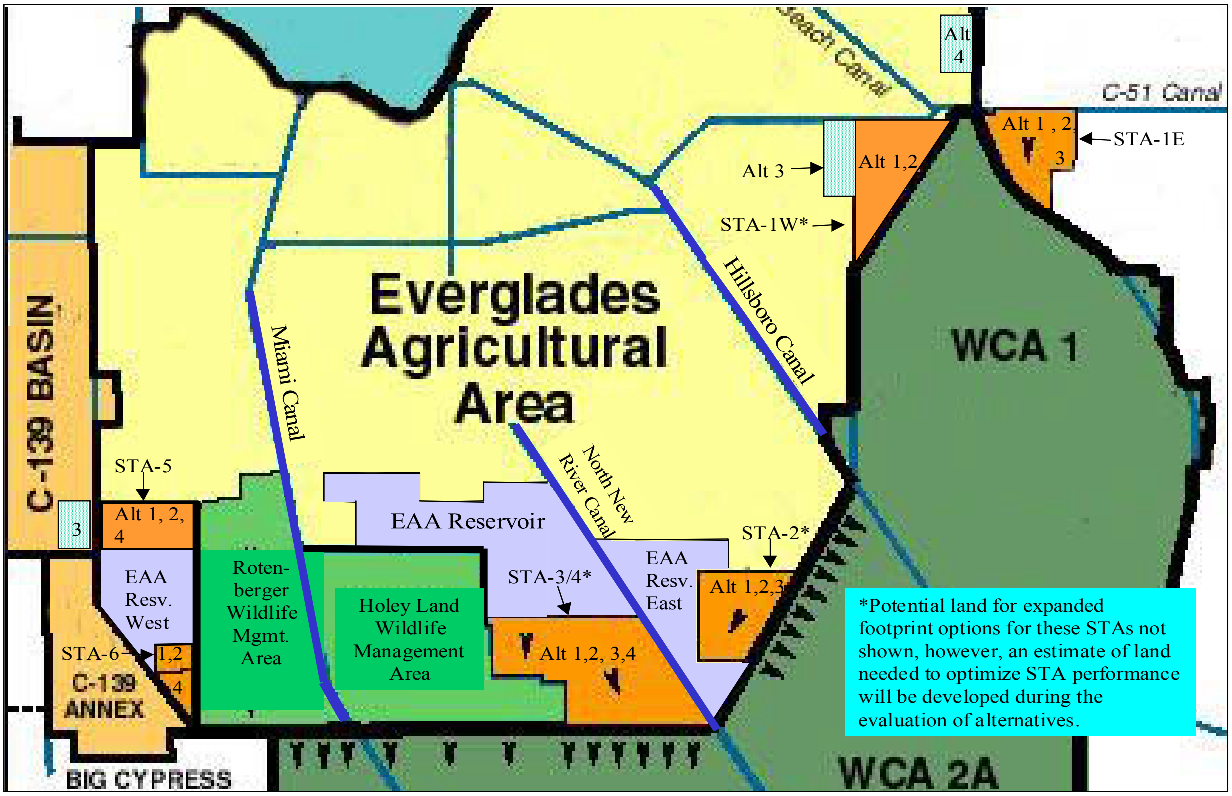


Table 2. Preliminary Alternative Combinations

Basin / STA	Alternative	Divert	Source Control	Basin-scale Treatment: Biological	Basin-scale Treatment: Chemical	CERP Project & Date
C-51 West / STA-1 East	1		✓	✓(within STA footprint)		
	2		✓	✓ (If needed, expand STA-1E and STA-1W)		
STA-1E and STA-1W	3 (includes Acme Basin B)		✓	✓ (Expand STA-1E and STA-1W to treat Acme B)		

Basin / STA	Alternative	Divert	Source Control	Basin-scale Treatment: Biological	Basin-scale Treatment: Chemical	CERP Project & Date
	4 (includes Acme Basin B)	✓ partial diversion to rock pit	✓	✓(within STA footprint)		
S-5A / STA-1 West	1		✓	✓ (within STA footprint)		
S-6 / STA-2	1		✓	✓ (within STA footprint)		✓ EAA Reservoirs (2014)
	2		✓	✓ (within STA footprint)		
	3		✓	✓ (within STA footprint)	✓	
S-7, S-8 / STA-3/4	1		✓	✓ (within STA footprint)		✓ EAA Reservoirs (2014)
	2		✓	✓ (within STA footprint)		✓ EAA Reservoirs (2014)
	3		✓	✓ (if needed, expand STA-3/4)		✓ EAA Reservoirs (2014)
	4		✓	✓ (if needed, expand STA-3/4)		✓ EAA Reservoirs (2014)
C-139 / STA-5 and EAA, C-139 Annex / STA-6 (Sec. 1 & 2)	1		✓	✓ (within STA footprint)		✓ EAA Reservoirs (2014)
	2		✓	✓ (within STA footprint)		✓ EAA Reservoirs (2014)
	3		✓	✓ (Expand STA-5 footprint to the west by 500 acres)		✓ EAA Reservoirs (2014)

Basin / STA	Alternative	Divert	Source Control	Basin-scale Treatment: Biological	Basin-scale Treatment: Chemical	CERP Project & Date
	4		✓	✓ (within STA footprint)		✓EAA Reservoirs (2014)
Integrated STAs	1		✓	✓		✓ EAA Reservoirs (2014)